Insurance, Entrepreneurial Start-Up and Performance*

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Abstract

Availability of (partial) insurance mechanisms is arguably important for the decision of (risk-averse) workers to start up a risky entrepreneurial venture. Using administrative data from Denmark, where unemployment insurance (UI) is available to both wage earners and self-employed on a voluntary basis, we estimate the causal effect of UI cover on the self-employment choice of wage earners after instrumenting for the UI choice. The instruments we use are based on a series of policy variations that took place at three points in time during an observation period spanning three decades: only UI covered individuals could under certain conditions qualify for an early retirement (ER) program. Changes (reforms) in the eligibility conditions of the program that affected different age groups differentially at these three different points in time, identify the UI choice process. Results show that the causal effect of insurance on the probability of starting up a venture is positive for would-be entrepreneurs, in contrast to correlations in the data or uninstrumented estimates. Using firm data, we also investigate how the newly insurance-induced entrepreneurs fare relative to their uninsured peers. Results suggest that they survive longer, but are not more likely to employ any workers or to make higher or lower profits.

Keywords: self-employment, insurance, entrepreneurs, unemployment, panel data, early retirement
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> “ *. . . self-employed workers cannot, by definition, become unemployed and [. . .] therefore have no need for unemployment protection. They are not bound by a contract of employment with another and if they terminate their own employment, it would seem to be a voluntary act. [. . .] [Yet], a shrinking demand for the products or services of a self-employed worker may often leave him in about as difficult a position as an unemployed wage earner. [. . .]*
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> ILO (1955, p. 50)

1 Introduction

The possibility of failure is inherent in being an entrepreneur. The availability of insurance, formal or otherwise, is arguably important for the start-up decision of risk-averse workers that envisage embarking on a risky business venture. Traditional occupational choice models (Kanbur, 1979; Kihlstrom and Laffont, 1979) assume only the risk-neutral or least risk-averse to select into entrepreneurship, conditional on being confident in their entrepreneurial plan. There is little supporting evidence, however, to suggest that small-scale entrepreneurs have no demand for insurance.[1]

Small firms are often perceived as being an important driver of technological progress and economic growth, and to bring about innovation in technical processes and marketable products. Hence, policies that encourage entrepreneurial risk taking and that help workers set up their own businesses, for instance by enabling access to or inducing take-up of insurance mechanisms of various sorts, may very well be instrumental for societal dynamics and income growth.

This paper investigates empirically to what extent insurance provision leads workers to become self-employed, and whether those selected by insurance are more or less successful entrepreneurs. The question whether insurance is conducive to start-up is an important one to ask but not an easy one to answer. The main reason lies in the absence of formal insurance mechanisms and the lack of variation in the data.[2]

[1] By this we mean preferences being characterized by risk-neutrality or risk-lovingness. Evidence from survey data, partly making use of psychometric measurements of risk aversion or stated-preference approaches, suggests that lower risk aversion favors entrepreneurship and start-up (see, for instance, Ekelund et al., 2005; Caliendo et al., 2009; Dohmen et al., 2011) but does not point to risk neutrality or risk lovingness. Low risk aversion or high risk tolerance is sometimes offered to explain why people choose entrepreneurship despite low average returns. In a theory paper, Vereshchagina and Hopenhayn (2009) describe a sorting mechanism induced by wealth or borrowing constraints and do not rely on preference heterogeneity.

[2] Clearly, there are other motives for taking up self-employment as a means to generate income, prominently among those

The present paper focuses on the effect of unemployment insurance (UI), which is a more direct way of insuring entrepreneurial effort than the mechanisms considered in the existing literature (bankruptcy or health insurance). We shall briefly review some related papers below in this introduction. There is no direct empirical evidence, as far as we know, on the UI margin, since in most countries UI is either not available at all to the self-employed (see the quote on top of the first page), or it is available to all by way of compulsory insurance, not offering interesting variation for the population of potential start-ups.

Our data are from Denmark where UI is both voluntary and available to both wage-earners and self-employed. Anyone can decide whether or not to join a (often industry specific) UI fund. This allows us to compare those that are insured with those that are not. To instrument for the insurance choice, we exploit exogenous variation due to policy rules that induce insurance take-up. Specifically, an early retirement (ER) program open only to members of UI funds provides the clue to our identification strategy. Program participants that wanted to keep the option of retiring early needed to enroll in the ER program (and thus insure themselves) well in advance. For instance, in the period before the year 1992, 50 years was the latest enrollment age (or, threshold age) leading to ER benefit eligibility from age 60 on.

Figure 1 shows the UI fund enrollment rate for workers aged 47 in 1992. To stay eligible for ER, a reform in 1992 demanded these people join the UI system immediately. The vertical jump illustrates the strength of the UI enrollment incentive caused by the 1992 ER reform. Other cohorts faced different threshold ages. FIG. 1

Our data span the period from 1980 to 2009. In total, three reforms of the ER system were implemented (in 1992, 1999 and 2007/8), that reduced the ER eligibility age in three discrete steps from 50 to 32, with those cohorts that happened to be older than the reduced threshold age at the time of reform having to join UI funds immediately—and thus receiving unemployment insurance protection—in order to stay ER eligible.

This suggests we can use the (series of reforms in the) ER eligbility rules as instruments for UI take-up in a model that explains workers' transitions to self-employment from being insured. Our main estimation approach relies on linear fixed effects (FE) instrumental variable (IV) regression. We allow

that lost their paid jobs and find it difficult to transit from unemployment to employment. Transitions to self-employment may then not be driven by risk attitude or insurance availability, see, for instance, Caliendo et al. (2009).

both insurance and self-employment entry choices to be affected by demographics and taste shifters, income and wealth. Importantly, we also allow for a very flexible way of incorporating age and period effects (cohort effects are taken care of by the FE).

Raw data suggest an average year-on-year transition rate into self-employment of just under 1%. Insured workers have a 0.8% probability, and uninsured workers a 1.5% probability to enter self-employment. The negative association between insurance and start-up survives (if muted) in a simple, uninstrumented self-employment transition regression, conditional on fixed effects and regressors. Using the ER reforms as orthogonal shifters for UI inflow, however, we measure a very strong and positive causal effect of insurance on start-up of 1.5%. The main result is very robust to a number of sensitivity checks that we perform. It suggests that important parts of the endogeneity bias are transmitted through time-varying unobservables that are not accounted for by classically perceived as 'fixed' parameters such as risk aversion or entrepreneurial ability. Additional results from bivariate random effects probit models point in the same direction, showing that the linear functional form assumption of the FE-IV estimates is not driving the result.

We then investigate in separate analyses the mid-term success of new entrepreneurs that were induced to take up insurance. We consider a broad range of outcome measures, from survival as self-employed three and five years ahead, to future employment creation and profit generation.

The positive latent average treatment effect of UI membership, as obtained from the IV estimator, supports the idea that indeed it is the insurance component of the hybrid UI/ER system rather than the early retirement aspect that draws workers into self-employment. Loosely speaking, being insured 'opens the door' to starting up ventures. Our results indicate that insured entrepreneurs do not fare worse than uninsured ones. Uninstrumented results show that insured entrepreneurs are more likely to survive as self-employed and have employees, but generate less profit compared to insured entrepreneurs. The causal effect of insurance, however, on all the performance measures is not significantly different from zero.

Previous literature, instead, has focused on two insurance mechanisms. The first is bankruptcy protection, which becomes relevant when the bankruptcy code allows the proprietor of a failed firm to keep some assets after debt discharge. The law then provides partial insurance by making possible a 'fresh start'. This is the case for Chapter-7 bankruptcy filings in the United States, and the variation in

observational data comes about by asset exemption-levels being state-specific. Such variation has been exploited in empirical work (Fan and White, 2003). In addition, the 2005 reform of the US bankruptcy code changed a number of provisions at the federal level, making debt discharge more cumbersome, and leading to time variation (Paik, 2013). A number of recent studies such as Primo and Green (2011), Lee et al. (2011), or Jia (2011) looks at how cross-country or cross-state variation in bankruptcy laws affects the proportion of self-employed in the labor force. In summary, leniency begets entrepreneurship. Note, however, that higher exemption levels may be associated with higher default rates, driving up interest rates and thus hindering start-up investments, or resulting in lenders rationing the borrowers (Berkowitz and White, 2004; Meh and Terajima, 2008; Akyol and Athreya, 2011).

The other main insurance-related mechanism discussed in the literature concerns the cost of health insurance. Gruber and Poterba (1994) document substantial variation in health insurance coverage rates among the self-employed in the United States. They estimate a price effect from a tax-subsidy on health insurance demand using the 1986 Tax Reform Act (TRA86) variation. Following Madrian (1994), a number of papers investigates the idea that losing access to employer-sponsored health insurance keeps people from moving from wage to self-employment (job lock). Velamuri (2012) uses the introduction of the TRA86 fiscal deductibility of private health insurance premiums to study the impact on the fraction of self-employed women with data from the US Current Population Survey (CPS). She finds that single women and married women who are not covered by their spouses' insurance are more likely to be self-employed after the tax subsidy was introduced compared to married women covered by their partner. Gumus and Regan (2009) study the effect of a series of changes in the TRA86 tax subsidy on health-insurance take-up and self-employment entry (and exit). They find a small significant effect on entry with CPS data. Heim and Lurie (2010) likewise study the effect of the increase in deductibility, but use US tax return data, finding significant effects on both entry and exit. Heim and Lurie (2013) use the same data and extend the analysis to take into account between-state variation with respect to health insurance regulation. Lightly-regulated states show highest responses. Fairlie et al. (2011) instead use a regression-discontinuity approach that distinguishes between those entering self-employment before and after the critical age of 65, from which on universal Medicare coverage leads to within-sample variation in insurance status. The authors find a significant treatment effect. DeCicca (2010) uses a reform of health insurance in New Jersey in 1993 that made it easier for self-employed to be covered

by health insurance. He finds an increasing fraction of self-employed in New Jersey relative to other states. Health insurance cost thus determine occupational choice, although the insurance effect is indirect as health insurance does not insure entrepreneurial risk, but at most a correlated background risk (Eeckhoudt and Kimball, 1992; Gollier and Pratt, 1996).

Our paper contributes to the literature in various important ways. First, we consider a formal (partial) insurance mechanism that is of first-order importance to the income generation process of small business owners. There are not many such programs available that one can think of. We suspect that risk averse would-be entrepreneurs will, in the absence of such formal mechanisms, resort to informal ways to self-insure, and surmise that those effects will be harder to identify empirically. Second, we use micro panel data that cover the entire population of a country and are thus able to precisely measure effects on small transition probabilities that are associated with overwhelming heterogeneity. Third, we have a large array of variables at our disposal that we are able to use as controls, among which measures of wealth, industry, labor market history, and health (sickness benefit receipts), all of which belong to the set of time-varying factors that determine choices. Fourth, and most importantly, we can determine the causal effect of insurance on start-up using idiosyncratic variation in insurance status, and hence control the insurance choice. Many papers in the literature analyze self-employment rates or self-employment entry in reduced-form settings that cannot distinguish directly between the insured and the uninsured, or that treat insurance status as exogenous (such as with exogenous location choice when studying the between-state variation in bankruptcy protection). Using the policy variations induced by three reforms we are able to construct six exogenous instruments that shift insurance without having first-order effects on the entrepeneurial start-up decision. Fifth, our paper appears to be the first to look at post-transition outcomes. While the bankruptcy and health insurance literatures identify an insurance mechanism, they are silent on characterizing the performance of the treatment group.

The rest of the paper is organized as follows: Section 2 sketches relevant institutional settings that are important for an understanding of the generation of the data and our empirical identification strategy. Section 3 introduces a simple model of occupational and insurance choice. Section 4 sketches details of our empirical approach. Section 5 presents the data we use along with descriptives illuminating salient patterns and trends. Section 6 presents empirical estimation results. Section 7, finally, provides brief conclusions.

2 Institutions

In this section we provide a short description of the legal and institutional setting for Danish entrepreneurs. We cover the period 1980-2009 and focus in particular on the income insurance aspects for entrepreneurs. We shall also explain in some detail the early retirement (ER) system, which is integrated into the unemployment insurance (UI) system. There were important reforms in ER eligibility rules—we exploit these in our empirical approach.[3]

2.1 Insurance Mechanisms

Starting up involves substantial risks borne by the individual entrepreneur. In Denmark, most of the self-employed run small unincorporated firms in sole proprietorship and 90% of all firms have less than 10 employees (in 1999). Among newly started firms about half survive the first three years and more than half of those who go bankrupt do not have any employees (see Statistics Denmark, 2009, 2010).

Self-employed entrepreneurs are protected by two main institutional income insurance mechanisms: bankruptcy proceedings and unemployment insurance. There are two types of proceedings in which the bankruptcy law foresees: those extending to corporate liabilities, and those intended for personal liabilities including debt of unincorporated businesses. The latter protection was included in the Bankruptcy Reform Act of 1984, making discharge of some part of debt possible for small firms, but typically involving a repayment plan out of income for the remainder of non-discharged debt. We argue, however, that bankruptcy proceedings are not of first-order importance for the majority of self-employed entrepreneurs in Denmark, unlike in the United States. Armour and Cumming (2008) list the various provisions of a number of bankruptcy acts in international comparison and show that the Danish legislation is substantially less forgiving than the US bankruptcy act. Unlike in the United States where insolvency is not a necessary condition for bankruptcy and debt discharge, filing for bankruptcy in Denmark is tied to being "hopelessly indebted and [. . .] the proceedings [being] warranted by the circumstances of the debtor" (Alexopoulos and Domowitz, 1998). Out-of-court settlements are subject to rules and discretionary negotiation outcomes. Thus, bankruptcy, insolvency, and debt restructuring will apply only in the minority of cases where a self-employed person terminates his business; typically, taking this route is associated

[3] This section draws partly on Ejrnæs and Hochguertel (2013) and partly on Economic Council (2011, p. 176–177, Box II).

with considerable delays. In many cases, decreasing or non-positive profits will be reason enough to close shop, without being insolvent.

The main income insurance provided in Denmark is the unemployment insurance system. Denmark is one of the very few countries where unemployment insurance is voluntary and where, quite uniquely, also the self-employed can insure themselves along with wage employed workers (Schoukens, 2000).[4] Comparing the number of registered firm bankruptcies (including the corporate ones) with the number of self-employed that subsequently register as unemployed, shows that the latter figure exceeds the former by 50% on average.[5]

The insurance system is organized around about 35 private, industry/occupation-specific UI funds. A typical UI fund is a not-for-profit organization without selection restrictions for applicant members. UI funds finance UI benefits through membership fees, payroll taxes and government subsidies.[6] There are mainly two funds that focus on the self-employed, DANA and ASE. The funds are free (within legal limits) to determine regulation of benefit entitlements, although there tends to be close alignment between funds. The eligibility rules as well as level and potential duration of benefits are in general the same for wage earners and self-employed, although there are small differences. Wage earners are allowed to insure themselves either as full-time workers or part time workers, whereas self-employed's insurance status is restricted to always being full-time.[7] To illustrate, according to ASE regulations, the self-employed entrepreneurs can file for UI benefits in cases where all of the following conditions apply:[8]

- the UI fund membership has lasted for at least 12 months
- the applicant has worked at least 52 weeks full-time during the past 3 years. Both work as a wage earner or work as a self-employed can be counted in for the 52 weeks[9]
- the applicant enrolls with the public job center from the first day of unemployment

[4] Sweden and Finland are the other examples mentioned in Parsons et al. (2003).
[5] See Ejrnæs and Hochguertel (2013). Numbers exclude the agricultural sector.
[6] Lentz (2009) reports that the average worker pays about 1/3 of the actual premium, the rest being subsidies.
[7] In what follows, we shall interchangeably speak of UI fund membership and being insured.
[8] The rules applied until 2009 and may have changed since.
[9] This rule has changed during our sampling period. The period used to be 6 months within the last 3 years.

- the applicant is willing to take on any job as a wage employee; the benefit recipient must perform active job search while receiving compensation
- the business is sold, liquidated, or leased (mutually irrevocably for a period of at least five years).

The self-employed may also temporarily suspend their business and register as unemployed upon experiencing an extraordinary event, such as fire. In such cases, the event must be beyond control of the self-employed and excludes ordinary industry risk. The idea is to insure idiosyncratic exogenous shocks. Incomes must have been critically exhausted.

Benefit duration can be characterized as generous in international comparison: This used to be 84 months until 1996, when it was reduced to 60 months; during the 1990s there have been changes also to include activation programs with mandatory participation that starts within 12 months of first registration. In 1998 the duration was further reduced from 60 months to 48 months.

Parsons et al. (2003) report for the year 1995 that the contribution paid by an individual amounted to about 3,600 DKK for a wage employed worker and to about 4,000 DKK for a self-employed person. These figures exclude administration costs, which can vary substantially across UI funds. The contribution is independent of earnings. For one of the large UI funds for self-employed (ASE) the contribution amounts to about 2.5 percent of the benefit.

For workers the benefit level is 90% of previous earnings subject to a floor and a ceiling. For self-employed the amount of the UI benefit is a function of an average of profits of the two best performing annual financial reports within the last five financial years during which the applicant was UI fund member. The parameters of that function are set centrally and are not at the discretion of the individual fund: the benefit rate equals 90% of the average profit (excluding interests, including depreciations and labor market contribution), bracketed by a ceiling and a floor. The ceiling/floor correspond to that for workers.[10] In the data, the majority (about three in five) of self-employed would face potential benefits corresponding to the ceiling, and much of the rest (about one in three) would see potential benefits corresponding to the floor.

Jobless persons not covered by UI fund benefits, including those who have exhausted the maxi-

[10]The ceiling amounted to a gross income of about 135,000 DKK p.a. in 1996, 173,000 DKK p.a. in 2006. 1000 DKK $\approx$ 134 Euro. The floor amounts to 82% of the ceiling, and is essentially due to minimum wage regulation that applies for wage employed (thus, about 142.000 DKK p.a. in 2006). For temporary suspensions, the benefit rate equals 80% of the ceiling.

mum benefit period, can receive social assistance. The social assistance depends on spousal income and individual circumstances, but is for the vast majority considerably lower than the UI benefit. To receive social assistance the requirements are that the person is registered as unemployed and is actively searching for a job. Municipalities can, however, coerce recipients to work in public sector jobs.

The voluntary nature of the UI insurance leads to people enrolling when they expect to need protection most. That is, there will be strong time patterns over the business cycle, but also patterns for certain age groups or cohort members. Such patterns are not always very discernible in two-dimensional pictures, but Figure 2 provides what we might call a heat map of UI entry. The column space is made up of the years in our sample (from 1981, since we measure new UI fund members in year t compared to $t-1$). The row space is made up of year-of-birth cohorts, and cells thus allow to define ages. Age changes from the south-west (low) to the north-east (high). The map thus contains empirical entry probabilities into UI. FIG. 2

Different levels of empirical entry rates as observed in the data are colored from green (low) to red (high). It is clear that older people are less likely to enroll (many of them are enrolled already), one may detect time patterns and possibly regularities for particular cohorts. There are, however, strong patterns ranging across the picture that are not explained by either age, cohort, or year effects alone. The most salient of those have to do with incentives emanating from the Early Retirement System, as we shall explain next.

2.2 The Early Retirement System and Its Reforms

The Danish ER system has been through three major reforms during our study period: in 1992, 1999 and 2007/8. We start by describing the system from 1980 to 1992 and then describe the three reforms in detail. The ER system is separately organized from the old-age retirement pension system, which is compulsory and foresees in retirement from age 67 onward. Integrated in the UI fund system, however, is an ER option open exclusively to UI fund members, allowing retirement at a reduced pension from age 60 onwards. The ER scheme was introduced in 1979, with an eye towards general labor market conditions at the time, and politically supported with the argument that it would bring relief to 'worn-out' blue-collar workers. However, access to the ER system is possible for both blue- and white-collar workers, and for both wage earners and self-employed. The latter have to sell their business before they

can claim benefits. ER provides insurance through the possibility of retiring from labor market activity at older ages. This may be relevant from the perspective of a young self-employed person who, when old might find it difficult to find a paid job in the event of his firm failing. Until 1992 UI fund members aged 60 and older used to qualify if they had been enrolled in the UI system for the last 10 years, typically leading to a spike in the enrollment hazard at threshold age 50.

In the period before 1999, there is no additional premium associated with benefiting from the ER plan. In other words, ER could be had at zero marginal cost for the interested participant. ER benefits correspond to the UI benefits, as discussed earlier. The early retirement benefit is in general higher than the (flat-rate) old-age pension and is not means-tested. However, once an individual has commenced his ER period, other labor market activities, and hence additional income generation possibilities, are largely precluded.[11]

The first major reform of the early retirement system took place in 1992. This reform concerned a policy shift that required continued membership of at least 20 (instead of 10) years before retirement, implying the latest age for joining a UI fund decreased from 50 to 40. Individuals aged between 40 and 50 in 1992 were required to join the UI fund in 1992 and stay members until 60 if they were to collect ER benefits (compare Figure 1 discussed in the introduction).

Figure 3 illustrates in a schematic overview how different cohorts are affected differently by this and subsequent reforms. The head column contains year of birth covering the relevant range in our data, the head row contains years in our data, entries are resulting ages. Gray areas are ages excluded from the data, the white and colored regions are included. The various colored areas indicate various regimes that applied for various cohorts or age groups at different points in time. The Table thus tries to make transparent that the ER policy reforms affected different age groups differentially in different years. The relation with the heat map of empirical entry rates (Figure 2) is immediately obvious. This comparison provides prima facie evidence that the ER incentive shifts UI coverage rates. We shall get back to this below in Section 4. FIG. 3

The next reform took place in 1999. It instituted five major changes: the maximum length of the ER period changed, ER-eligibility rules changed, an independent ER contribution was introduced, new rules of how to calculate retirement benefits were implemented, and a bonus for not using the retirement

[11] Small-scale activities, amounting to not more than 200 hours worked per year, were admissible.

option was introduced. In correspondence to lowering the old-age pensionable age from 67 to 65 in 1999, ER benefits could be drawn during ages 60 to 64. The second element of the reform was to increase the required number of membership years in a UI fund from 20 to 25 years. Similar to the 1992 reform, transitional rules applied to the cohorts between 35 and 39 years of age in 1999. The third element of the reform was the introduction of a separate ER contribution. The contribution should be paid for at least 25 years with those older than 35 years paying the contribution from 1999 until the age of 60. This contribution amounted to 5,520 DKK in 2012.[12] The fourth element of the reform was a change in the benefit level formula, regarding taking into account the level of private pensions available to the individual. Benefits were reduced depending on the size of such alternative pension claims. Furthermore, the ER benefit recipients' cap on admissible hours worked (200 per year, see note 11) was removed. The last element was a bonus given to those who were eligible for ER but decided to postpone ER beyond the age of 62. The size of the bonus increased for each quarter of postponement until reaching the age of 65.

OECD (2006) illustrates the incentive effects of the ER system for the sub-periods 1992-1998 and 1999-2006 by showing that the 'implicit tax on continued work' from age 60 onward exceeded 50% in the early period. Due to these incentives and because of its generosity, ER became a very popular exit route from the labor force, eventually causing financial strain to the system and hampering productivity growth. In the second period after the 1999 reform, the implicit tax estimate decreased to about 30%.

The 2007/8 reform increased the number of years required to be in a UI fund to 30 years for ER eligibility purposes. The ER entry age was in addition gradually increased to 62 for cohorts born in 1963 or later. This implied that individuals desiring to benefit from the ER system needed to be UI members from the age of 32.[13] The empirically relevant variable for enrollment is the implied age

[12] This contribution is additional to the fee for the UI fund. The latter amounted to about 4,000 DKK in 2012 (depending on UI fund). Note that with the introduction of the ER contribution in the 1999 reform the fee for UI was actually lowered, and only grew very slowly since.

[13] Furthermore, it was announced that by 2019 the ER entry age would be 62 for all cohorts. A dependence of ER (and old-age pension) entry ages on the development of life expectancy was also introduced. Such changes are not subject of the present analysis.

threshold and not membership duration per se.[14,15] But the 2007/8 reform also introduced an additional option to join for individuals that were older than their threshold age, but that were at least 15 years removed from ER entry ages. We call such individuals 'latecomers'. They would face reduced future ER benefits, however.

3 A simple model of occupational and insurance choice

3.1 The environment

In this section we set up a simple model for occupational and insurance choice. The model is inspired by Evans and Jovanovich (1989) but extended with the state of unemployment and with an insurance choice.[16] The purpose of this model is to illustrate the main mechanisms through which insurance affects occupational choice.

Consider an agent that has to choose between two occupations: entrepreneur or wage earner. In both occupations there is a risk of unemployment. The agent can take up an unemployment insurance that will provide an income in case of unemployment. To simplify the exposition we consider a static model, where the agent makes the occupation and insurance choice before the state of the world is revealed. We also ignore the non-monetary utility of being self-employed.

Let d denote the chosen occupational status: $d = 1$ if the agent chooses to be an entrepreneur and $d = 0$ if he is a wage earner. Furthermore, we assume that the agent has initial wealth W.

If the agent chooses to be a wage earner, he will receive earnings Y^W and thus command over cash-on-hand of size $Y^W + W$ while employed. He will receive

$$Y^{UW} = sB + (1-s)A$$

[14] To be precise, the rules are framed in terms of minimum numbers of contribution years. When we speak of minimum required enrollment periods of 10 (20, 25, 30) years, the actual rules allow for some additional slack by specifying that the individual needs to have paid contribution at least during 10 (20, 25, 30) out of the last 20 (25, 30, 35) years. For the purposes of constructing our instrument in our empirical work we rely on the implied minimum enrollment period of 10 (20, 25, 30) years, since this is not subject to choice.

[15] The implementation of the 2007/8 reform allowed a number of practical exceptions, leading to changes becoming relevant for many individuals only as of January 2008. In our empirical analysis we have considered the 2007/8 reform to alternatively come into effect in 2007 or 2008, without, however, finding our main conclusions to be affected.

[16] We introduce uncertainty as risk of unemployment while Kanbur (1979), Kihlstrom and Laffont (1979) and Vereshchagina and Hopenhayn (2009) have uncertainty in profits or project returns that entrepreneurs can generate.

when unemployed, likewise to be augmented by wealth W. Here, B is the benefit level if insured, $B > 0$, and A is the income if not insured. A can be social assistance or informal insurance provided by the family, $A \geq 0$. The unemployment benefit will depend on the insurance status s, where $s = 1$ indicates being insured and $s = 0$ indicates not being insured. Taking out insurance involves having to pay a premium, P.

If the agent chooses to be an entrepreneur he also has to decide on an investment strategy for his initial wealth. We can impose borrowing constraints by assuming that the entrepreneur can borrow up to a certain fraction of his wealth: $(\lambda - 1)$. This implies that the entrepreneur can invest at most λW, where $\lambda \geq 1$. If $\lambda = 1$ no borrowing is possible. We will first solve the model ignoring the borrowing constraint and then we will return to the borrowing constraints issue in sub-section 3.5.

If the entrepreneur is successful his total resources will be

$$Y^E = \gamma k^\alpha + (W - k)$$

where k is the investment size and γ captures entrepreneurial ability. We assume that $\alpha \in (0;1)$ which implies decreasing returns to the investment. If he is unsuccessful he will become unemployed. Income for an unemployed entrepreneur is given by

$$Y^{UE} = sB + (1-s)A + W - k.$$

The probability of becoming unemployed depends on the occupation; π^E and π^W. If $\pi^E > \pi^W$, entrepreneurship is riskier than wage employment.

The agent maximizes expected utility. We assume a standard concave utility function u, where $u' > 0$ and $u'' < 0$. The agent's problem is given by

$$\begin{aligned} \max_{d,s} \quad & (1-d) \cdot \{(1-\pi^W) \cdot u(Y^W + W - sP) + \pi^W \cdot u(sB + (1-s)A + W)\} \\ + \quad & d \cdot \{\max_k [(1-\pi^E) \cdot u(\gamma k^\alpha + (W-k) - sP) + \pi^E \cdot u(sB + (1-s)A + (W-k))]\}. \end{aligned}$$

3.2 The entrepreneur

3.2.1 The optimal investment

To solve the model we start by finding the optimal level of investment in case of entrepreneurship. The first order condition for k is given by

$$(1-\pi^E)\cdot u'(Y^E - sP)\cdot(\gamma\alpha k^{\alpha-1}-1) - \pi^E \cdot u'(Y^{UE}) = 0. \tag{1}$$

We can now derive the optimal investment. Let k^{*1} (k^{*0}) be the optimal investment for an insured (uninsured) agent. We can show (see Appendix B) that

$$\begin{aligned} k^{*1} &= k(\underset{-}{\pi^E}, \underset{+}{B}, \underset{-}{P}, \underset{?}{W}, \underset{?}{\gamma}), \\ k^{*0} &= k(\underset{-}{\pi^E}, \underset{+}{A}, \underset{?}{W}, \underset{?}{\gamma}). \end{aligned}$$

Subscripts below the symbols indicate the sign of the partial derivative of the function with respect to the argument in question. We shall use this convention also in what follows.

Based on the model we can derive the following predictions:

- The optimal investment, $k^{*1} = k^{*0} = (\gamma\alpha)^{1/(1-\alpha)}$ is maximal when there is no risk of becoming unemployed ($\pi^E = 0$) and the borrowing constraint is not binding. In this case the investment is independent of wealth W (and of insurance status).[17] If the probability of unemployment is one, $\pi^E = 1$, the optimal investment is zero, whether insured or not $k^{*1} = k^{*0} = 0$.

- The investment of an insured agent is always higher than or equal to that of an uninsured agent, $k^{*1} \geq k^{*0}$. The intuition behind this result is that an uninsured agent has to keep a larger fraction of his wealth as precautionary balance in the case of unemployment. The investment is equal if the probability of unemployment is either zero or one. The difference in the investment between the insured and uninsured ($k^{*1} - k^{*0}$) depends on the value of the benefit B and the premium P. If B (P) is large (small) the difference in investment will be large. We can also show that if W tends to infinity, the difference between an insured agent and uninsured agent will diminish.

[17] A similar result is obtained in Evans and Jovanovich (1989).

- The income as an entrepreneur Y^E is an increasing function of investiment for $k \in \left(0, (\alpha\gamma)^{1/(1-\alpha)}\right)$. It follows that income of an insured entrepreneur is higher than income of an uninsured entrepreneur, $Y^{E1} \geq Y^{E0}$. This suggests that the causal effect of insurance on income as an entrepreneur is positive.

- The effect of wealth is ambiguous and is determined by the curvature of marginal utility, u''', and the relative size of $sB+W-k$ and $\gamma k^{\alpha}+W-k-sP$. For instance, if the benefit level B, and the probability π^E are high, insured agents will lower their investment as wealth increases.

- The effects of entrepreneurial ability are ambiguous. Based on simulation exercises with simple parameterizations, we conjecture that in many cases investment is increasing in ability.

3.2.2 The insurance choice and expected utility

We can now consider when it will be optimal for an entrepreneur to insure himself. The agent will choose to be insured if the expected utility when insured is higher than when uninsured. Let U^{E1} and U^{E0} be the expected utility for the optimal investment, indexed by insurance status (0 or 1):

$$\begin{aligned} U^{E1} &= (1-\pi^E)\cdot u(\gamma(k^{*1})^{\alpha}+(W-k^{*1})-P)+\pi^E\cdot u(B+(W-k^{*1})) \\ U^{E0} &= (1-\pi^E)\cdot u(\gamma(k^{*0})^{\alpha}+(W-k^{*0})) \qquad +\pi^E\cdot u((A+W-k^{*0})) \end{aligned}$$

We can show that expected utility depends on π^E, B, P, W and γ as follows:

$$\begin{aligned} U^{E1} &= U^{E1}(\underset{?}{\pi^E},\underset{+}{B},\underset{-}{P},\underset{+}{W},\underset{+}{\gamma}), \\ U^{E0} &= U^{E0}(\underset{-}{\pi^E},\underset{+}{A},\underset{+}{W},\underset{+}{\gamma}). \end{aligned}$$

The optimal insurance choice can be determined based on comparing expected utilities: $s^{E*}=1$ if $U^{E1}>U^{E0}$. We can show that for an entrepreneur insurance take-up is a function of various variables, as follows[18]

$$s^{E*} = s(\underset{+}{\pi^E},\underset{+}{B},\underset{-}{A},\underset{-}{P},\underset{?}{W},\underset{?}{\gamma}). \tag{2}$$

[18]The effect of γ appears to be impossible to sign unless we introduce additional restrictions.

To develop some intuition, we provide a set of illustrative figures generated under some parameterization of our model. In Figure 4 we show the optimal investment and expected utility for an insured and an uninsured agent. In the figure, we see that the expected utility for an uninsured entrepreneur is monotonically decreasing in the probability of unemployment. The expected utility for an insured entrepreneur will first be decreasing. If the investments are becoming so low that income falls below the benefit level, the expected utility will start to increase in the probability of unemployment. FIG. 4

The impact of wealth on insurance is ambiguous. For some values of π^E, B, P and γ it will be the wealthy agents who will benefit most from an insurance. For other values it will be the least wealthy who benefit most. In Figure 5 we show an example where the least wealthy will choose an insurance while the wealthier individuals will not. FIG. 5

Interestingly, we can show that if the premium is sufficiently high the demand for insurance is larger for high-ability entrepreneurs than for low-ability entrepreneurs. The reason is that the return to the investment is much bigger for high ability entrepreneurs. Therefore, the high ability entrepreneurs will prefer to invest more and this will lead to a large income difference between the states of employment and unemployment. The insurance will decrease this gap and allow for higher investment (see Figure 6). This suggests that offering insurance for entrepreneurs will not necessarily attract the agents with lowest abilities. FIG. 6

3.3 The wage earner

Similarly, we can find the expected utility for an insured and uninsured wage earner. If we assume that the income from working will always exceed the benefit, $Y^W > B$, we will have

$$\begin{aligned} U^{W1} &= U^{W1}(\underset{-}{\pi^W}, \underset{+}{Y^W}, \underset{+}{B}, \underset{-}{P}, \underset{+}{W}) \\ U^{W0} &= U^{W0}(\underset{-}{\pi^W}, \underset{+}{Y^E}, \underset{+}{A}, \underset{+}{W}). \end{aligned}$$

From the standard model it follows that the insurance decision is determined as follows

$$s^{W*} = s(\underset{+}{\pi^W}, \underset{+}{B}, \underset{-}{A}, \underset{-}{P}, \underset{?}{W}). \tag{3}$$

3.4 The occupational choice

Turning to the occupational choice, we first consider the decision of an uninsured agent. The agent will choose to be an entrepreneur $d^{*0} = 1$ if $U^{E0} > U^{W0}$. We can then show that

$$d^{*0} = d(\underset{-}{\pi^E}, \underset{+}{\pi^W}, \underset{-}{Y^E}, \underset{?}{A}, \underset{?}{W}, \underset{+}{\gamma}). \tag{4}$$

The wealth effect is in general ambiguous but if we assume that income as successful entrepreneur is higher than wage earner income, $\gamma(k^{*0})^\alpha - k^{*0} \geq Y^W$, and that entrepreneurship is riskier than wage employment, i.e. $\pi^E \geq \pi^W$, then there will be a positive effect of wealth on entrepreneurship. This shows that even in the absence of borrowing constraints there can be a positive wealth gradient in the entry to self-employment.

For insured agents we can similarly show that

$$d^{*1} = d(\underset{-}{\pi^E}, \underset{+}{\pi^W}, \underset{-}{Y^E}, \underset{?}{B}, \underset{?}{P}, \underset{?}{W}, \underset{+}{\gamma}). \tag{5}$$

The same considerations about the wealth effect apply. Furthermore, if $\pi^E \geq \pi^W$ the benefit level B will increase the likelihood of choosing to be an entrepreneur.

Now we compare the region in which an insured and an uninsured agent will choose to be an entrepreneur. In Figure (7) we show the contours of the difference in utility. In this particular example, we see that there are more individuals who will choose to be an entrepreneur if they are insured, especially among the high ability and low-wealth types. Furthermore, we see that the wealth gradient is much stronger for uninsured compared to insured. This suggests that in this example insurance weakens the dependence on wealth. FIG. 7

It might also be interesting to compare the average income as entrepreneur for those who are insured with those who are uninsured. To do so we need to take account of two facts. On the one hand the insured will have a lower level of entrepreurial ability than the uninsured, on average. On the other hand, the insured with the same level of ability will have higher income as an entrepreneur. Therefore it is not possible to sign the difference in average income between insured and uninsured entrepreneurs.

We end this section by summing up the main predictions of the model which we will take to the data.

In the model we show that while keeping fixed the level of ability, wealth and perceived probability of unemployment, insurance will have a positive effect on the likelihood of start-up. We interpret this as a causal positive impact of insurance on the start-up probability. We also show that the correlation between insurance and start-up can be either positive or negative due to the endogeneity of the insurance status. Furthermore, we show that conditional on ability, wealth and the perceived unemployment probability, insured entrepreneurs will invest more than uninsured entrepreneurs, which again will lead to higher income for insured entrepreneurs compared to uninsured entrepreneurs. The prediction of the model is a positive causal effect of insurance on the investments and on earnings. The model also predicts that the correlation between investment and insurance can be either positive or negative.

3.5 Borrowing constraints

We now briefly discuss the implication of borrowing constraints. Since we always have that insured entrepreneurs invest more than uninsured entrepreneurs, the insured entrepreneurs are more affected by the borrowing constraints. This implies that the insured entrepreneurs in the case of borrowing constraints will invest less. Therefore the difference between having an insurance and not having one will diminish. Figure 8 is similar to Figure 7, where we impose a no-borrowing-constraint. This figure FIG. 8 is similar to Figure 1 in Evans and Jovanovich (1989). Our figure shows that the uninsured entrepreneur is unaffected by the introduction of a borrowing constraint while the insured entrepreneur will lower his investment. This leads to a small region in which it is beneficial to be an entrepreneur. In particular, low-wealth types with high ability do not prefer to be an entrepreneur any longer.[19]

Based on the graphs we can conclude the following:

- Both borrowing constraints and precautionary savings lead to a positive wealth gradient in the entry to self-employment.

- The borrowing constraint makes insurance less useful.

[19] Such predictions are qualitatively in line with some of the scenarios considered by Mankart and Rodano (2012) in a general equilibrium model where protection in bankruptcy provides the main insurance mechanism, and with Vereshchagina and Hopenhayn (2009) where exogenous borrowing constraints lead to wealth-driven selection into risky (the rich) and non-risky (the poor) occupations.

3.6 Identification issues and implications for empirical work

We shall in this paper focus on presenting estimates based on empirical data, and have our specification guided (in a looser sense) by some of the predictions of our theoretical model. The main aspect is to uncover the effect of insurance status on the self-employment decision.

As we have shown in the previous subsections, having an unemployment insurance can affect the choice of occupation. In the previous example we saw that for certain combinations of wealth and abilities having an insurance increases the expected utility as an entrepreneur above the expected utility as a wage earner. This suggests that the insurance can have a causal effect on the choice of occupation. However, it is also clear from the model above that the choice of insurance may be endogenous. From equations (2) and (3) it is clear that the choice depends on the (perceived) probability of becoming unemployed. The choice of occupation also depends on the unemployment probabilities. This simple fact could induce a correlation between insurance choice and occupation choice without being a causal relation.

However, unless we are able to fully control in our empirical work for (perceived) unemployment risk, the correlation between occupation and insurance cannot be interpreted as the causal relation that we are interested in. Possibly equally important is that also other confounders such as ability as an entrepreneur, degree of risk aversion and access to informal insurance may lead to insurance status being endogenous to the occupational choice. In the results Section 6 we discuss the potential correlation between insurance and entry to entrepreneurship in more detail.

To identify the causal effect of insurance on the choice of occupation, we exploit the ER feature of the Danish UI system: for some agents (at some ages) additional benefits associated with the insurance are available, see Section 2.[20] The benefit R is the option to retire early, which—depending on the time period—can be used at least 10 (20, 25, 30) years after the insurance choice has been made. By assuming time-separability between today where the insurance choice is made and the future where the retirement option can be exercised, we can model the retirement option as an additive term enhancing

[20] This idea is also used in Ejrnæs and Hochguertel (2013), albeit with reliance on the 1992 reform only and studying somewhat different issues.

utility, where β is a discount factor. The problem of the agent is then

$$\begin{aligned}\max_{d,s} \quad & (1-d)\cdot\{(1-\pi^W))\cdot u(Y^W+W-sP)+\pi^W\cdot u(sB+(1-s)A+W)\} \\ + \quad & d\cdot\{\max_k[(1-\pi^E)\cdot u(\gamma k^\alpha+(W-k)-sP)+\pi^W\cdot u(sB+(1-s)A+(W-k)]\}+s\beta R.\end{aligned}$$

Due to additivity, optimal investment and choice of occupation conditional on insurance status are unaffected by the additional benefit. Optimal insurance status will, however, be affected positively. This implies that the problem is

$$s^{E*} = s(\underset{+}{\pi^E},\underset{+}{B},\underset{-}{A},\underset{-}{P},\underset{?}{W},\underset{+}{R},\gamma) \tag{6}$$

$$s^{W*} = s(\underset{+}{\pi^W},\underset{+}{B},\underset{-}{A},\underset{-}{P},\underset{?}{W},\underset{+}{R}) \tag{7}$$

By using the variation in insurance status caused by the additional benefit we can identify the effect of insurance status on occupation. The identifying assumption is that the discounted value of the retirement option is uncorrelated with the unobserved individual effects such as unemployment risk, π^E and π^W.

4 Empirical Modeling and Implementation

We mainly rely on estimates from linear probability models where we allow for fixed individual effects and endogenous regressors that we instrument. In addition, we shall show some results from using a bivariate random effects probit model, as in Ejrnæs and Hochguertel (2013). The latter serves to check on whether the linearity presumed in our main estimates seriously affects our estimates—small transition rates to self-employment suggest that we are in the tail of the distribution.

We can interpret the set-up as a two-equation system. The first equation (first stage) refers to the probability of becoming insured conditional on the instrument (lagged ER eligibility), and the second equation (second stage) refers to the probability of becoming self-employed conditional on lagged insurance choice. We lag the insurance choice once since the variable measures insurance status at a point late in the year (week 48, see page 24). Both equations allow for individual fixed effects that can be arbitrarily correlated. Likewise, the idiosyncratic errors between both equations are allowed to be correlated. We need to make the usual orthogonality assumption between the remaining, time-varying

error in the instrumenting equation and the regressors and instruments used, and between the error in the instrumented equation and the instrument set conditional on regressors.

Introducing notation for the econometric model, let y_{jit} denote choice variable j (say, the demand for insurance or the propensity to start up) for individual i at time t. We model this as a function of a vector of observables x_{jit}, as well as unobservables,

$$y_{jit} = \beta_j x_{jit} + \eta_{ji} + \varepsilon_{jit}.$$

The individual fixed effects η_{ji} capture factors that are relevant for the two decisions of the agent (start-up and insurance) that we model, but unobserved by the econometrician. We might think with η_{ji} of technology parameters such as entrepreneurial ability, or preference parameters such as risk aversion, for instance, but we can also imagine that η_{ji} proxies for access to external finance. These examples suggest that allowing for correlation among the unobservables is potentially important.

We start the analysis with estimating (standard) linear fixed effects models for start-up, y_{2it}, and include in x_{2it} the uninstrumented lagged insurance indicator y_{1it-1}. This model is interesting in its own right, as it may give us some understanding as to the importance of sorting in a heterogeneous population into entrepreneurship. However, it is potentially misspecified as it disregards the endogeneity of insurance. To take account of the latter, we model the insurance decision by a function of observables and unobservables and include instrumental variables. Fully spelled out, the model is:

$$\text{(insurance)} \qquad y^{\star}_{1it} = \gamma z_{it-1} + \beta_1 x_{it} + \eta_{1i} + \varepsilon_{1it} \tag{8}$$

$$\text{(start-up)} \qquad y^{\star}_{2it} = \alpha y_{1it-1} + \beta_2 x_{it} + \eta_{2i} + \varepsilon_{2it} \tag{9}$$

In terms of our model sketched out in Section 3, these equations combine the self-employment decision conditional on insurance status (4) and (5) with the insurance choice (6) and (7).

The instrumental variables in (8) capture the various institutional regimes regarding ER eligibility that applied in various sub-periods of our observation period. We collect those in a vector, z, to make sure that the identification of α is not driven by functional form assumptions. Given proper handling of the insurance endogeneity, and under the linearity assumption of the model, the resulting coefficient of

insurance from (9) corresponds to the local average treatment effect.

For reference, we list the six instruments that we may be able to use, depending on length of sample, along with the variable labels employed in our results tables.

- A binary indicator for whether a person of a certain birth year (or age) in a certain year needed to be enrolled in UI for ER eligibility purposes
  - In the years 1991 and before: "ER regime $<$ 1992". In Figure 3 this corresponds to the two blue-shaded regions.
  - In the years 1992 to 1998: "ER regime $92-98$". In Figure 3 this corresponds to the two yellow-shaded regions.
  - In the years 1999 to 2006: "ER regime $99-06$". In Figure 3 this corresponds to the three green-shaded regions.
  - In the years 2007 and onwards: "ER regime $>$ 2006". In Figure 3 this corresponds to the red region.
- The number of required years for paying ER contribution, effective as of 1999: "# contr. years". This is calculated per birth cohort for years 1999 and later, falling into the following colored areas: light-blue, light-yellow, three shades of green, orange, and red. Note that the green-gray, light-green, orange and red areas (cohorts 1960 and younger of age 32 and higher, in year 2006 and later) signify additional changes that came about in 2006 when the early retirement entry age was raised to 62 years.
- A binary indicator for the possibility to join the ER system with the prospect of facing reduced benefits later (so-called 'latecomers'), afforded by the 2007/8 reform: "sign up late option". In Figure 3 this corresponds to the light-green area.

As this paper is about insurance channels we also would want to control for additional ways of self-insurance that the household has, outside formal insurance markets. One aspect concerns controlling for wealth, that our model suggest might be important anyway. Wealth may directly serve as buffer for temporary shocks (including business failure) and thus provide insurance functions. In addition, those self-employed (men) with a partner (typically wives) may have recourse to informal insurance through

their partner's labor supply.[21] Assuming that the wife makes optimal labor supply decisions, she may, to the extent that she earns below her maximal capacity, be in a position to increase her labor supply in the event of her husband's firm failing or for some reason generating sub-optimal incomes. This view requires very high labor market flexibility in terms of job mobility and hours choice, as is actually the case in Denmark.

We construct a measure of the unused earnings capacity (or remaining labor supply flexibility) by estimating auxiliary models from our data on women. As we do not observe hours worked in the data we are unable to calculate the difference between actual and maximal hours worked. However, we can go down a similar avenue for earnings since actual earnings are observed precisely in the data. The maximal earnings that a woman of given characteristics[22] can generate may be calculated as the upper envelope of earnings of comparable women in the sample. In order to do this, we estimate stochastic frontier models and define maximal predicted earnings as coinciding with the stochastic frontier. The unused earnings capacity is then the difference between the actual earnings and the frontier.[23] For implementation, we draw a 1% sample from our data of women in the age range 18-67, and predict earnings conditional on regressor values for the entire population. We can then control for spouse earnings and its insurance effect by including both the frontier (level of earnings) and the unused capacity.

For our analysis on post-transition outcomes we use, where possible, the entire population of self-employed that started up in year t, and perform cross-sectional types of analyses. These are simple OLS and IV (2SLS) models, not accounting for unobserved individual-level heterogeneity.

5 Data and Descriptives

5.1 Register Data

The data we use are comprehensive register data made available by Statistics Denmark to the Center for Applied Microeconometrics (CAM) at the University of Copenhagen. In terms of variables measured,

[21] A strand of literature in labor economics discusses the 'added worker effect' (see, e.g., Juhn and Potter, 2007, for references and recent analysis), where a working spouse's labor supply variation acts as self-insurance mechanism for the household. A recent semi-structural paper discussing consumption insurance in the face of endogenous labor supply decisions within the household is Blundell et al. (2012) who find the household labor supply margin to be an effective self-insurance device.

[22] The regressor list includes functions of age, education, labor market experience, industry, health, region of residence, country or region of origin, marital status, number of children by age, birth cohort, and time.

[23] in terms of stochastic frontier models, the unused capacity corresponds to the technical inefficiency parameter.

this is one of the world's richest administrative micro data sets. The data covers the entire residential population in Denmark, totalling 5.1-5.5m individuals every year. All individuals are followed over time, annually, from 1980 onwards until 2009. Individuals only enter through birth or immigration and only leave through death or emigration. In addition to population, tax and benefits register information on individuals, we also use data from linked employer-employee registers, and in addition from linked VAT registers. We exploit such information when assessing the performance of young firms some years after start-up. Profit (and related) measures are available from 1987 through 2009, sales and VAT information are available from 1990 through 2007.

Due to its administrative nature, the data is very reliable in terms of measuring observable income reports, benefit receipt, and tax file and UI insurance status of individuals, and of firm statistics. Labor market status is recorded in calendar week 48 (late November) of any given year. Individuals are classified self-employed according to their main economic activity in that particular week.

To be specific, the self-employed include those that are employers but also those without employees, those that assist as spouses, and those that are VAT registered. If a person both has a wage earner job and also runs his own business the status is determined by the main activity in week 48. There is a small group of people that are classified as self-employed but also receive wage earnings (and reverse).[24]

We shall rely in most of our analyses on random samples, representing 25% of the population. This restriction is chosen for computational convenience, but leaves very large samples. Sample size is important because transitions are not very frequently observed, and there is substantial heterogeneity requiring large samples in order to reliably measure responses to policy variation and changes in characteristics.

We restrict the data according to a few observable variables, in order to reduce heterogeneity. First, we only consider Denmark-born males with Danish citizenship. Second, we restrict attention to the age group of 25-59 year olds, since we are primarily interested in individuals choosing UI fund membership and occupation before actually exiting into early retirement. We exclude all individuals that in the period 1980-2009 have been working in the agricultural sector, either as wage earners or self-employed. Sectoral change strongly affected employment opportunities for these people.

This base data set contains 1.9m persons who are followed over up to 30 years, totalling 30m ob-

[24] In our base data set, over the span of 30 years, one third of individuals ever received self-employment income and wage income, but typically not simultaneously. The average share of self-employment income in total income, per individual and year, is about 14%.

servations. For estimation purposes, we also condition on being wage earners in period $t-1$ and not having had a spell of unemployment during $t-1$. We only consider transitions into self-employment as opposed to staying wage earners.[25] We retain a total of 19m observations from 1.6m distinct individuals. Of those, we draw a 25% sample for estimating IV FE models. We use the whole population when analyzing performance measures. The lag structure in the regressor set further reduces the estimation samples slightly.

5.2 Self-employment and unemployment insurance

Table 1 shows labor market status over time. We see that the fraction of self-employed has declined over the period, starting from about 10 percent in 1980, moving down to 6.8 percent in 2009. The average was about 8 percent for the whole period. In the period about 83 percent are wage-earners. The remaining 9 percent are either unemployed or out of the labor force. The fraction of non-employment reflects to a large extent the business cycle with high levels of unemployment in the beginning of the 1980s and 1990s, and recently in 2008/9. The table also shows the wage employed more likely to be insured than the self-employed or the unemployed (the latter group includes some individuals out of the labor force, however). The total number of observations is increasing over the period, reflecting population and labor market growth. TABLE 1

Table 2 shows the transitions into and out of self-employment. On average, 1 percent of wage employed become self-employed in a year, while 3 percent of unemployed start up. 8 percent of self-employed leave between years to become employees, 3-4 percent become unemployed. The decreasing stock of self-employed suggests that average exit is larger than average entry. Exit rates in particular are sensitive to changes in overall economic conditions (entry rates not much); recessions drive self-employed out of business. TABLE 2

If we break down the entry rate by birth cohort as in Figure 9, where each line represents a birth cohort, we infer that both time and age effects are present. In the left panel the entry rate is displayed as a function of calendar time. It clearly shows that calendar effects are present, e.g. in 1990 where FIG. 9

[25] Denmark has, as other countries, specific start-up schemes for unemployed former workers. One such example is described and evaluated in Hombert et al. (2013) for France. For Norway, Røed and Skogstrøm (2013) evaluate the effect of changing UI benefit duration on transitions out of unemployment to either employment or self-employment. We, however, want to emphasize the effect of a formal insurance scheme that lasts beyond the start-up phase, and does not provide additional incentives to become self-employed as opposed to finding a wage job.

the transition rate dropped for almost all cohorts. Turning to the right panel we see that the entry rate displays a clear age pattern. The entry rate increases until the mid 30ies and then starts to decline. Furthermore in both graphs we see patterns consistent with cohort effects.

Now we turn to investigate the unemployment insurance status. In Table 3 we display the probability for non–UI fund members to sign up, focusing on the regime change of the 1992 reform. This shows that the entry probability among non-member wage-earners is about 9 percent, except in the last year before the threshold age is reached. In that last year the probability is 22 percent. Similar patterns are found for the self-employed, but not for the unemployed. The incentive to join the insurance system is strongly affected by the changed eligibility criteria. TABLE 3

Table 4 finally shows a cross tabulation of insurance status (in year $t-1$) and self-employment start-up (year t) as measured in our estimation sample (which conditions on being a worker in period $t-1$). The insured have a probability of 0.8% to start up, the uninsured are more likely to become entrepreneurs at almost twice that rate (1.5%). The average transition rate is just short of 1%. We shall in the next sub-section that the raw difference of -0.7 percentage points between the insured and the uninsured has no causal interpretation.

6 Results

6.1 Start-Up and Insurance

Table 5 reports coefficient estimates along with associated p-values obtained from fixed effects (FE) regressions, with and without instrumentation. The underlying sample corresponds to 25% of the relevant population (see the data Section 5 for definition) that is 'at risk' to make a transition into self-employment in year t. We interpret the coefficient estimates as marginal effects on the probability to start up owing to our interpretation of the model as a linear probability model. The specifiation controls for a number of important personal or household characteristics, such as age (as a fourth-order polynomial), experience as wage earner (as a third-order polynomial), measures of wealth (net worth in levels and home ownership) and income (wage earnings and sickness insurance benefit receipts), the number of children in the household (by age group), as well as a number of characteristics of the partner of the individual. Sickness insurance benefit receipt doubles as health (illness) measure. TABLE 5

The partner characteristics (apart from a dummy whether or not a partner is present in the household) are age, whether or not UI fund member, whether participating actively in the labor market, and measures of the partner's earnings capacity (see Section 4). All specifications control in addition to the reported effects for a full set of year dummies, and for comprehensive sets of region and industry dummies. Interesting as those might be, we shall, however, abstract from discussing them for brevity. Details are available upon request. Many of our variables, at least those that might change easily between years and are potentially correlated with the errors, are lagged at least once, if not twice. By using such predetermined values we mitigate remaining concerns about endogeneity associated with some of the regressors, in particular wealth and income.

We start the discussion of our empirical estimates with results from an uninstrumented model ignoring potential endogeneity of the insurance choice. The first set of columns in Table 5 shows a significantly negative coefficient of 0.15% on the insurance dummy. It is small in size compared to the raw correlations (see Section 5). The estimate suggests that the raw data difference of -0.7 percentage points (Table 4) is overstated by the impact of observed and unobserved heterogeneity; the insured and uninsured differ in important dimensions. Those that are uninclined to sign up for insurance are more likely to switch to self-employment.

The age polynomial, with all terms significant, suggests a positive but decreasing gradient in the probability to start up with age. The experience polynomial displays a countervailing effect, negative and decreasing in time spent as wage recipient. We keep the rest of the discussion somewhat short as the present model is not the main specification of interest: positive coefficients are estimated for home ownership, as well as for sickness benefit receipt. Demographics including spouse characteristics appear not to matter much, as their marginal effects are very small; the unused earnings capacity of the partner is positively associated with starting up.

As detailed, we have reasons to believe that modeling the insurance choice as endogenous to the self-employment transition decision is important. The first and second stage of the instrumented model are displayed in the second and third set of columns in Table 5. We use all of our six instruments discussed in Section 4. Each instrument is statistically significant, and the F-test on joint significance shows that they are important determinants of the insurance choice. The J test cannot reject the validity of the overidentifying restrictions. Selection into insurance is strongly impacted by the first age thresh-

old applying in the pre-1992 period, as the first of our instrumental variables suggests. The marginal effect is 5.3 percentage points. In the period after the 1992 reform and until the 1999 reform the age threshold increased the probability of insurance enrollment by 5.5%. In the regime of the 1999 reform the impact of the age threshold has decreased to 3.4 percentage points and the last period from the 2007/8 reform the effect of the age threshold is 2.2 percentage points. Our results confirm that the effect of the retirement option has been weakened over the entire period, with and fewer individuals reacting to the incentive. This is consistent with the fact that early retirement has been made less beneficial by the reforms implemented over the period. There is a small effect of the number of contribution years, i.e., the minimum number of years during which the enrollee has to pay ER contributions (as introduced in 1999) in order to be ER eligible from age 60 (62) on. This is captured by our fifth instrument. The effect is positive. A possible explanation for the sign is the coincidental reduction in the UI insurance fee introduced at the same time. The last of our instruments also has a positive effect. It becomes relevant with the 2007/8 reform and allows those that otherwise 'missed the deadline' (latecomers) to still sign up for the ER program at reduced future benefits. It has an additional effect of yet another 2 percent additional insurance membership. All in all, ER incentives are instrumental in pulling individuals into UI.

The insurance decision is also determined by the other regressors we control for. All of the displayed coefficient estimates have p-values below 0.5%. The age pattern in insurance is largely falling, except for in the first couple of years when it increases. Recall that we control for year dummies and capture cohort effects through the FE. Experience is positive and near-linear in the 0-20 years range. Experience will proxy for life-cycle wage profiles, and even current (or better, lagged) wage levels have a positive effect on insurance. Wealth effects are non-linear. We see this when looking at the variables measuring net worth in levels and home ownership. Wealth in itself has a negative impact, homeownership a positive. This would suggest that the effect of financial wealth, which fulfills an important self-insurance and liquidity function, dominates the measured wealth effect on insurance. In that light, the coefficient possibly reflects substitutability between insurance channels. Similar remarks apply to some of the spouse variables that we include, in particular whether the partner works, and what her level of earnings is (measured by the earnings frontier). The unused earnings capacity also is significantly negative in the insurance equation, as expected under insurance substitutability.

Turning now to the self-employment transition equation reveals a significant and positive effect of insurance on start-up. The magnitude is substantial with more than 1.5 percentage points, compared to a baseline average transition rate of 1% and 0.8% for the insured in the raw data. The fact that the conclusions are very different from the uninstrumented and unconditional cases shows that not only heterogeneity but also endogeneity matter. Apparently there are factors that determine both insurance choice and start-up, unaccounted for in the regressor set and the FE, that lead to less insurance and more entrepreneurship. Many of the other effects that we measure in this equation are similar to the uninstrumented case, in terms of sign, significance level and magnitude.

6.2 Sensitivity Checks

The main finding of a 1.5 percentage point causal effect of insurance on start-up is very robust. We display in Table 6 results from a battery of sensitivity checks that we perform. None of the alternative specifications challenges our estimates in Table 5. Most variations we display take place within the setting of the linear FE IV model, but we briefly discuss alternative approaches from a random effects probit model below. Line 1 of the new Table shows that the functional form for entering net worth does not affect the coefficient estimate on the instrumented insurance dummy. While the dummy variables (corresponding to bins over the distribution of net worth) help capture nonlinear patterns in the regression function, the coefficient of interest is unaffected. The latter holds true even when we exclude net worth altogether (line 2). TABLE 6

One of the innovations in our specification is the use of an estimated earnings frontier for spouses. If we replace the frontier by the actually observed earnings to capture the earnings level, the coefficient on the instrumented insurance dummy (line 3) is also unaffected. Using the spouse's earnings prediction in logs instead of in levels changes nothing (line 4). Further, neither has reducing the age polynomial to order 3 (line 5) nor using age dummies (subject to restrictions) instead of polynomials (line 6) large effects; each variation reduces the insurance coefficient only very slightly. The simplest specification relies exclusively on variation in age and time (dummy variable approach) and ignores all other time-varying regressors (line 7). The immediate effect is that the sample becomes larger as we do not lose observations due to lagged regressor values. The model is worth considering because it makes the weakest assumptions on the unobservables and keeps the functional flexibility in the conditioning

set. It falls into the class of models considered by Blundell and Powell (2003) to non-parametrically identify the impact of discrete endogenous variables with discrete instruments (also see Appendix A in Ejrnæs and Hochguertel (2013)). The fact that this lowers the insurance coefficient suggests that the time-varying heterogeneity otherwise captured by the omitted regressors is of importance to characterize the pools of insurees and would-be entrepreneurs.

The final variation within the FE-IV model we consider concerns the number of instruments we use. For instance, we can drop the last two instruments (number of contribution years and sign-up late option) without affecting at all the estimate of the coefficient of interest (line 8).

We lastly display estimates from random effects probit models. We choose those because they impose a nonlinear functional form on the conditional probability that we estimate, which might be important since in particular with respect to the transition rate to self-employment we model a small-probability event. The location in the tail of the distribution may hence be impacting on the parameter estimates. This model takes considerably longer to estimate. For computational reasons, we use a 1% sample and perform the estimation on a slightly different regressor set. The coefficient estimates displayed in Table 6, lines 9 and 10, point in the same direction as the coefficient estimates from the linear FE base specification, however. Both the univariate model, corresponding to the uninstrumented base line scenario, and the bivariate model, corresponding to the instrumented model in Table 5 each display a sign on the coefficient coinciding with the linear model estimates. Marginal effects (not shown) are somewhat smaller in absolute value than the coefficients, largely comparable to the linear model estimates. In addition, the bivariate model allows us to explicitly estimate correlation coefficients between the unobservable random effects in both equations, and those of the errors. Both are large and significantly negative.

The sign reversal in coefficient estimates between the univariate (uninstrumented) and bivariate (instrumented) case, observed in the base specification of Table 5, together with the evidence of strongly negatively correlated errors and individual effects just discussed, suggests that individual-specific unobservables that let people choose insurance are strongly correlated with individual-specific factors that let workers abstain from self-employment.

6.3 Firm Performance and Insurance

This paper deviates from much of the rest of the literature on insurance-induced entrepreneurship by actually assessing how the new entrepreneurs fare when they are insured.[26] Table 7 shows how outcomes correlate with insurance status in the raw data. We now use the full population of self-employed that started from wage employment between period $t-1$ and t. Around 60% of those that started in t are not around anymore after three years. However, the insured are more likely to survive to at least period $t+3$, with a significant difference of 7 percentage points. Note that survival here means survival as self-employed, or better: being observed to be self-employed end November of each year in $t+1$, $t+2$, and $t+3$. Firms of the self-employed are not guaranteed to survive this long, as we do not hold constant a firm identifier. TABLE 7

Conditional on survival to $t+3$, we may also look at other outcomes, partly obtained from linked employer-employee data. The data is available to us for the sub-period 1987-2009. Profits are incomes generated by the entrepreneur (self-employment income) plus retained earnings that are kept in the firm and are not directly available for consumption by the owner. For most firms (median), profits of surviving insured entrepreneurs are higher than the profits of surviving uninsured ones. This is not true on average, however, since mean profits of the uninsured are higher. The uninsured are also more likely to incur losses or make zero profit. The difference is 5 percentage points.

We also have access to VAT register information (for a shorter time span from 1990 to 2007). We calculate value added as the difference between sales revenues and expenses. Similar to the average profit figures, both sales revenues and value added are negatively correlated with insurance.

The last outcome measure we can analyze is employment.[27] Small firms quite often only employ their owner and no-one else. Those with employees often employ 10 or fewer workers. Assuming that firms grow over time in both financial terms and in terms of the number of workers, we may measure performance in terms of whether any other workers are being employed (except for the self-employed

[26] As far we are aware, this is the first such paper. However, there are related papers that look at post-reform outcomes or outcomes in relation to institutional variation in slightly different contexts. Hombert et al. (2013) study the case where unemployed former workers would retain their entitlements to UI benefits if their start-up venture failed, comparing industry groups according to pre-reform prevalence of sole-proprietorship. They then study outcome measures post-reform and post start-up. Cerqueiro and Penas (2011) study the effect of across-state variation in bankruptcy protection (i.e., the intensive margin of insurance) on the financing structure of firms (own capital v bank credit), firm growth rate (employees and revenues) and on exits.

[27] We were able to link data with an establishment identifier to the relevant set of individuals for the period 1994-2008.

person himself). The insured entrepreneurs are 6 percentage points more likely to employ others compared to the uninsured entrepreneurs.

Again, Table 7 displays correlation patterns in the data, not causal effects. Table 8 shows results of IV regressions for selected performance measures. These are cross-sectional estimates where we cluster on person-ID to take into account that a small fraction of entrepreneurs makes it more than once to our sample of newly started firms. The underlying sample conditions on start-up between years $t-1$ and t. We consider the three measures 'survival', 'profits', and 'having employees' (being an employer). All outcome variables are observed at time $t+3$, and for the latter two measures, we also condition on survival to $t+3$. We also include a full set of year, region, industry, education, and year of birth dummies in the specification. The latter two sets capture time-invariant variation that in previous analyses would have been taken care of by the fixed effects. In all cases, the instruments have satisfactory impact on the insurance decision. We only discuss the causal impact of insurance. TABLE 8

This parameter is insignificantly different from zero all models, on survival, profit, and being an employer. This suggests that while insurance causes start-up, survival probabilities conditional on start-up are unaffected by insurance. There is, however, still a long-term effect of insurance on the number of firms in business, even though (or because) insurance does not affect the failure rate. Likewise for profits: insurance does not select firms that are otherwise particularly profitable, but it also does not select lemons. In fact, we do find positive effects of insurance on all the performance measures (although they are not significant).

Finally, Tables 9 and 10 subject the specifications shown in Table 8 to various sensitivity checks. TABLE 9,10

The first set of variations in Table 9 instruments for initial insurance choice, and conditions the sample on entry between $t-1$ and t. Variation 1 measures whether the self-employed survives to $t+3$ (in the above sense) while not having wage income; we dub those 'full-time' self-employed. This measure thus tries to remove contaminations into the sample by people that partly rely on wage earnings. This changed definition does not affect the parameter estimate nor the conclusion.

Line 2 measures the causal impact of survival until $t+5$. The effect is substantially smaller than for $t+3$, but again not significantly different from zero. If, instead we look at the joint probability to enter and survive, the estimated coefficient is positive and significant, for both horizons (lines 3 and 4). Combined with an entry rate due to insurance of 2.9%, the numbers here suggest that about half of the

firms do not survive until $t+3$ and two thirds do not survive until $t+5$. The results also suggest that the main effect is due to start-up in itself. The *J* test rejects the overidentifying restrictions in this model, however.

Lines 5 and 6 show the uninstrumented equivalents to the estimates in Table 8 and in line 2. We find that OLS estimates are significantly positive, for both time horizons. This might be interpreted as evidence of negative selection into insurance through heterogeneity. The estimates show that those that are observed to be insured are 7 to 9 percentage points more likely to survive five or at least 3 years than those that are not insured.

The last lines in Table 9 concern employment outcomes. An alternative measure of employment is not just having employees but the total size of the workforce (aggregated across all establishments in case there is more than one). The IV estimate suggests again a positive, if insignificant effect: The insurance leads on average to about 6 more employees (line 7). Line 8 shows the uninstrumented equivalent of the result in Table 8. This estimate is positive and significant, indicating that insured self-employed are 2 percentage point more likely to have employees.

We further discuss the results on profit and related measures in Table 10. Apart from profits (including retained earnings) we can consider sales revenues and value added, business income (excluding retained earnings) and total income (including wage income). We also check on accumulated wealth and its change between years. All IV estimates of the causal effect are statistically zero, and signs point in different directions between specifications (lines 11 through 17). Note, though, that trying to predict profits, revenues or value added from the available regressor set is challenging, all measures vary widely. Line 14 therefore attempts to introduce some stability into the profit measure by averaging across a number of years; we select years $t+3$ through $t+5$. Conditioning remains on survival as self-employed, this time until $t+5$. Again, the effect of insurance is zero.

Lines 15 through 17 deserve further comment, as we here do not condition on survival until $t+3$. Self-employment is a labor market status that is closely linked to the legal status of the firm. A firm that changes status from unincorporated to incorporated (whether or not going public), will see its owner change labor market status from self-employed to non-self-employed. Since changing legal status is often associated with size or growth and success, we might select against the most successful ones if we condition the data on surviving as self-employed (thence unincorporated firm) until $t+3$. Therefore,

lines 15-17 only condition on start-up between $t-1$ and t. We then measure success by total income (which, in case of firms that became incorporated, includes the wage earned by the owner, line 15), by total net worth of the owner (line 16), or by the change in net worth between $t-1$ and $t+3$ (line 17). The idea in the latter two variations is that if successful self-employed sell their firm, their private net worth would increase. None of these variations leads to any different conclusions, however.

Many of our instrumented effects are pointing in different directions, although they tend to be insignificantly different from zero. Our uninstrumented effects (lines 20 through 27), on the other hand, suggest clear negative effects. Insured entrepreneurs fare worse in terms of income and profit (although the difference is at most at modest 45 k DKK), but better in terms of survival and being an employer. Again, heterogeneous sorting effects into insurance will play a large role in explaining the difference between the IV and the OLS estimates.[28]

Our empirical results are consistent with most of our predictions from the theoretical model. We do find a significant positive causal impact of insurance on start-up probability. In the absence of direct measures of investments we look at number of employees as an indicator for investments. We also find insignificant positive causal effects of insurance on the number of employees, profits, and income measures. One possible explanation for our inconclusive result is that our empirical measures of income and profit relate to the short run return of the investment. So even if insured entrepreneurs invest more we might not see the return to the larger investment with our relatively limited time horizon of 3 to 5 years. Further analyses trying to understand the dynamics would require setting up a dynamic model, which is beyond the scope of this paper.

7 Conclusions

The role that insurance provision may play in helping workers to transit into entrepreneurship and start up risky ventures is the focus of a recent strand of literature. Clearly, if new entrepreneurs contribute to technical innovation and economic growth, then protecting them from some of the consequences of that

[28] We have, in addition to the reported results, analyzed a number of models where we study the effect of insurance on outcomes where outcome measures are not conditional on survival. That means, we have replaced missings with zeros if a firm that started up did not survive until a given horizon. Results of these exercises are available on request. Even though they cannot be summarized succinctly, most results point into the direction that among those that ever started up, insurance is not conducive to better or worse performance (outcome). Often, parameter estimates are drawn towards zero compared to the results reported in our Tables.

risk, may encourage entrepreneurship and hence growth.

Available studies to date have centered around two large insurance mechanisms: lenience in bankruptcy regulation (possibility for debt discharge and partial asset retention) and availability of subsidized health insurance. Both are rather indirect ways of insuring entrepreneurial risk taking. In both cases, individual insurance status is not always observable in empirical data, or variation in insurance status is assumed exogenous.

We, instead, focus on a more direct way of insurance—unemployment insurance available to workers and self-employed alike. The empirical data we use are from Denmark, whose unique institutional setting we exploit to identify the effect of insurance on start-up. What is particular about the Danish case are two main aspects: (i) unemployment insurance is available to all self-employed and workers alike on a voluntary basis, and (ii) an early retirement system is embedded in the UI system that provides additional incentives to sign up for insurance many years before the ER option is actually exercised.

As such, these institutional features are sufficient to estimate the effect of insurance on start-up, since (i) they provide variation in insurance status in the population, (ii) help construct instruments that change insurance demand without having a direct effect on the self-employment transition.

Insurance take-up and entrepreneurial start-up vary with age and over time, and between different cohorts. In order to make sure that the ER instrument actually is not being picked up by the rather flexible specification we allow in the age and time dimension, we make use of the fact that the ER eligibility criteria were changed a number of times during our 30-year observation period. Making use of such natural experiments over a long span of time in the particular start-up and insurance setting is the main methodological contribution of this paper to the existing literature.

For much of our econometric work we rely on instrumental variable models with fixed effects in both the instrumented and the instrumenting equation. We find that insurance has a positive causal effect on start-up, after instrumentation for the insurance choice. Not instrumenting leads to a reversed sign, reflecting the unconditional correlations observed in raw data—entrepreneurs are less likely to be insured. The sign reversal after correction for endogeneity is accompanied by strong negative correlations in the unobservables. We find this explicitly in bivariate random effects probit estimates.

The second main contribution to the existing literature on the insurance/entrepreneurship nexus concerns an in-depth analyis of post-transition performance measures. Using linked employer-worker infor-

mation, we can use firm characteristics to gauge to what extent the new insurance-induced self-employed fare better or worse than their uninsured counterparts. We focus on measures three years after the transition into self-employment has been made, and consider outcome measures such as employment, profits (including retained earnings) and value added. Whereas the overall picture is somewhat mixed, it appears fair to say that insurance does not select people into self-employment that are in any way less successful.

A further question of interest is to what extent insurance causes moral hazard among the self-employed, i.e., do those that have signed up for insurance behave differently and, for instance, take less care to avoid failure. This is addressed in Ejrnæs and Hochguertel (2013). Moral hazard explains about 30% of the overall failure rate.

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Appendix A Figures and Tables

Appendix A.1 Figures

Figure 1: Unemployment Insurance Incidence, Men Born 1945

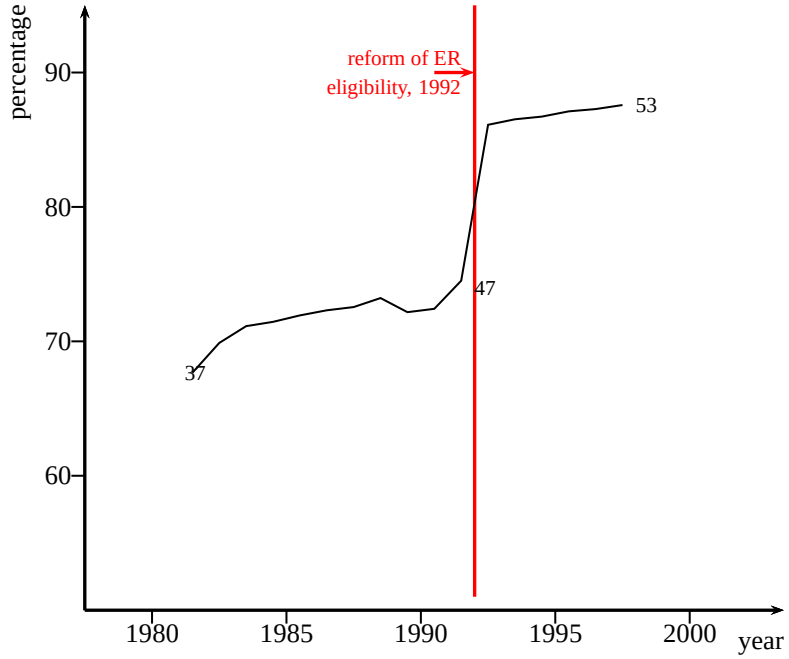
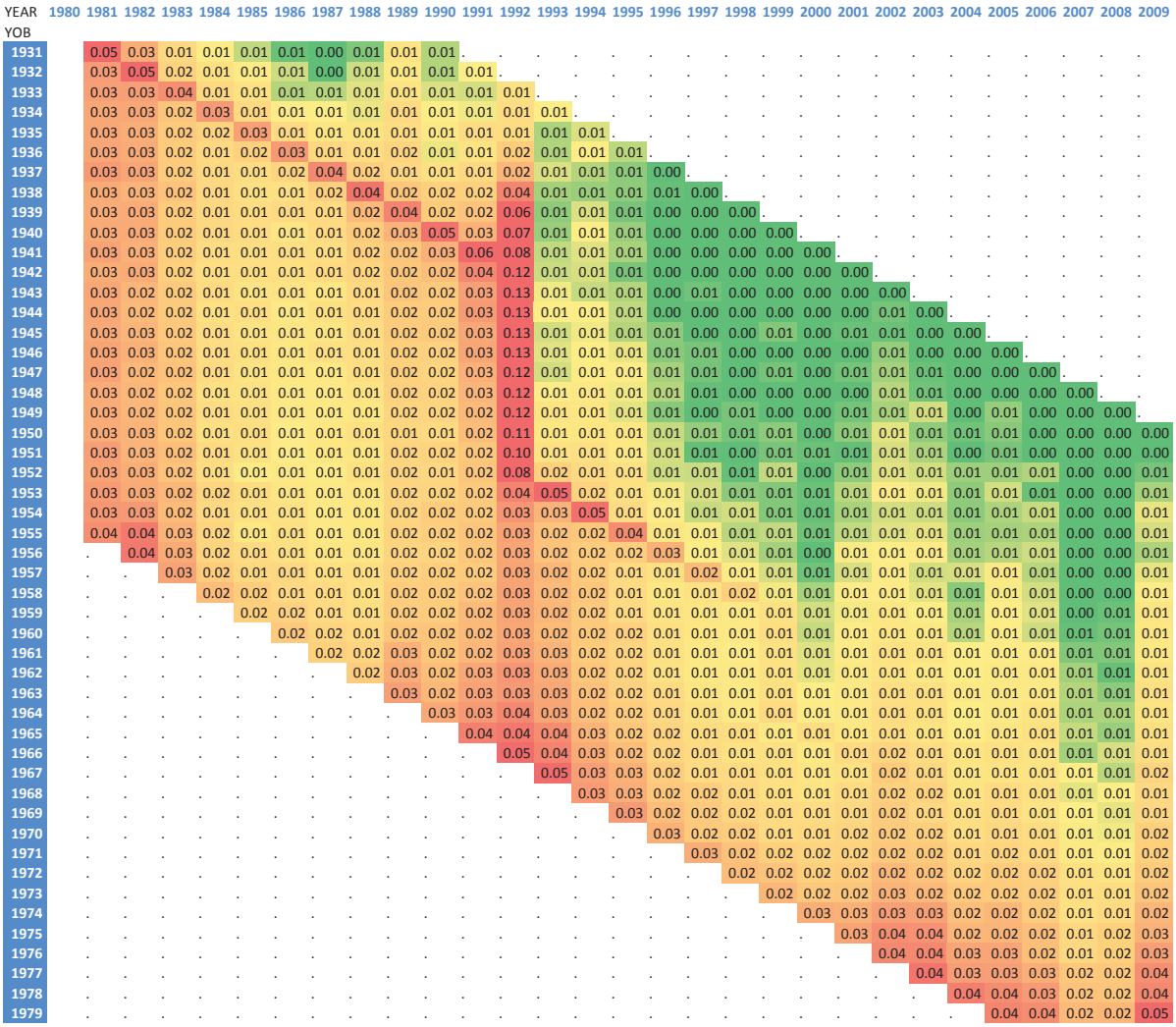


Figure 2: UI Entry Rates, by Year-of-Birth Cohort and Year ('Heat Map')



Note: Map shows cohort-year specific entry rates into UI as observed in the data (working males). Colored area corresponds to data restriction (ages 25-59). Green: below-average entry rates, red: above-average.

Figure 3: Regimes of Early Retirement Rules, by Year-of-Birth Cohort and Year

YEAR / YOB	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
1930	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79
1931	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78
1932	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77
1933	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76
1934	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75
1935	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74
1936	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73
1937	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72
1938	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71
1939	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70
1940	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69
1941	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68
1942	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67
1943	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66
1944	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65
1945	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64
1946	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63
1947	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62
1948	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61
1949	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60
1950	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59
1951	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58
1952	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57
1953	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56
1954	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55
1955	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54
1956	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53
1957	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52
1958	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51
1959	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50
1960	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49
1961	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48
1962	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47
1963	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46
1964	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45
1965	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44
1966	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43
1967	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42
1968	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41
1969	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40
1970	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39
1971	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38
1972	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37
1973	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36
1974	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35
1975	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34
1976	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33
1977	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32
1978	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
1979	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30

LEGEND

sample exclusions

- not in sample (likely not yet participating in the labor market or potentially eligible for early retirement)
- not in sample, eligible for old-age pension

minimum required insurance ages to qualify for early retirement at the earliest age (60-62 depending on cohort and year)

- initial situation, valid from 1980
- those unaffected by the 1992 reform, but affected by the contribution requirements from 1999 on
- those affected by the 1992 reform
- those affected by the 1992 reform, and by the contribution requirements from 1999 on
- those affected by the 1999 reform, and those affected by the "sign-up-late"option from the 2007/8 reform
- those affected by the 2007/8 reform
- those affected by the 2006 change of early retirement age of up to 62 (increase in contribution years)

instrument sets

- ER regime < 1992
- ER regime 92-98
- ER regime 99-06
- ER regime > 2006
- # contr.years
- sign up late option

Figure 4: Optimal Investment [l] and Expected Utility [r] for Entrepreneurs as Functions of Unemployment Risk, by Insurance Status

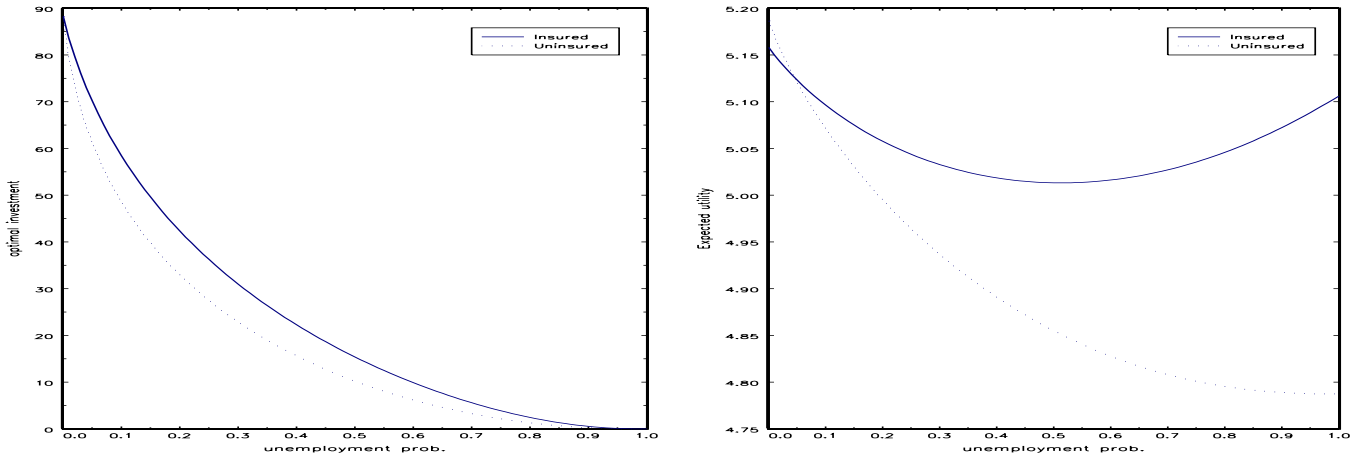


Figure 5: Optimal Investment [l] and Expected Utility [r] for Entrepreneurs as Functions of Initial Wealth, by Insurance Status

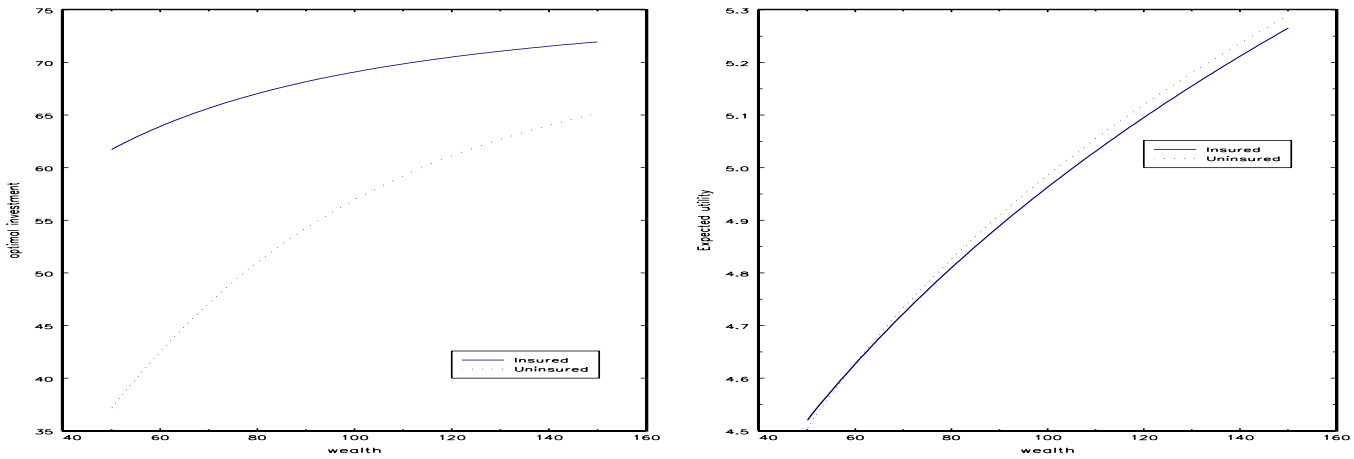


Figure 6: Optimal Investment [l] and Expected Utility [r] for Entrepreneurs as Functions of Ability, by Insurance Status

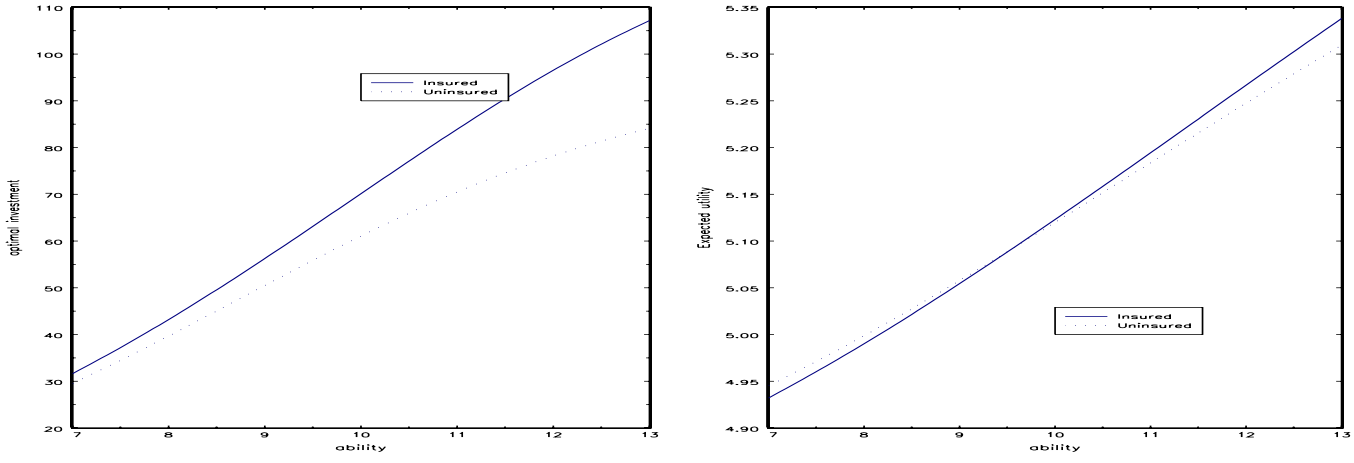


Figure 7: Occupational Choice as a Function of Wealth and Ability, by Insurance Status [l/r]

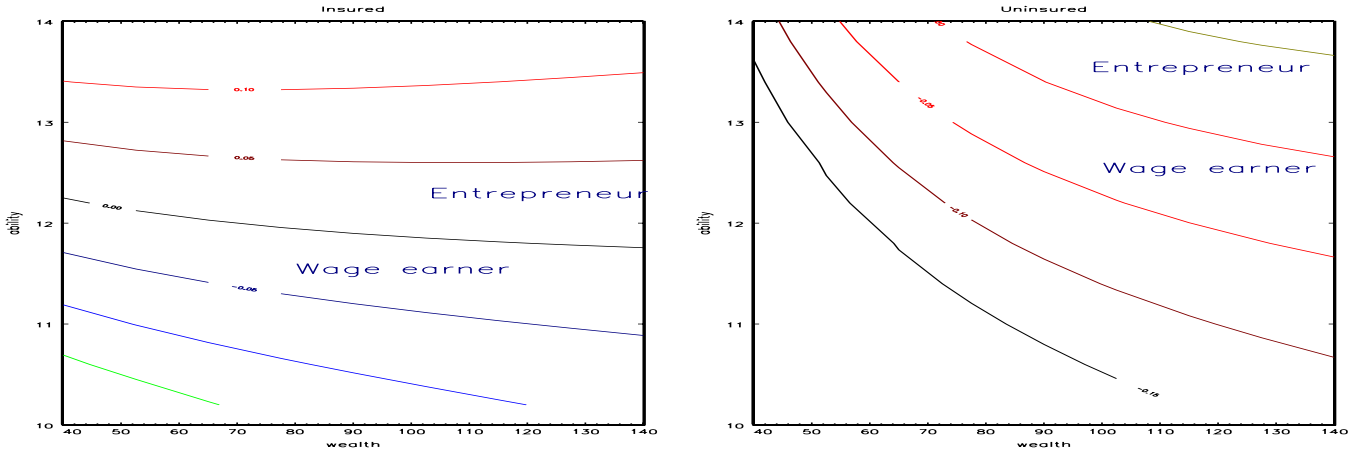


Figure 8: Occupational Choice Under Borrowing Constraints as a Function of Wealth and Ability, by Insurance Status [l/r]

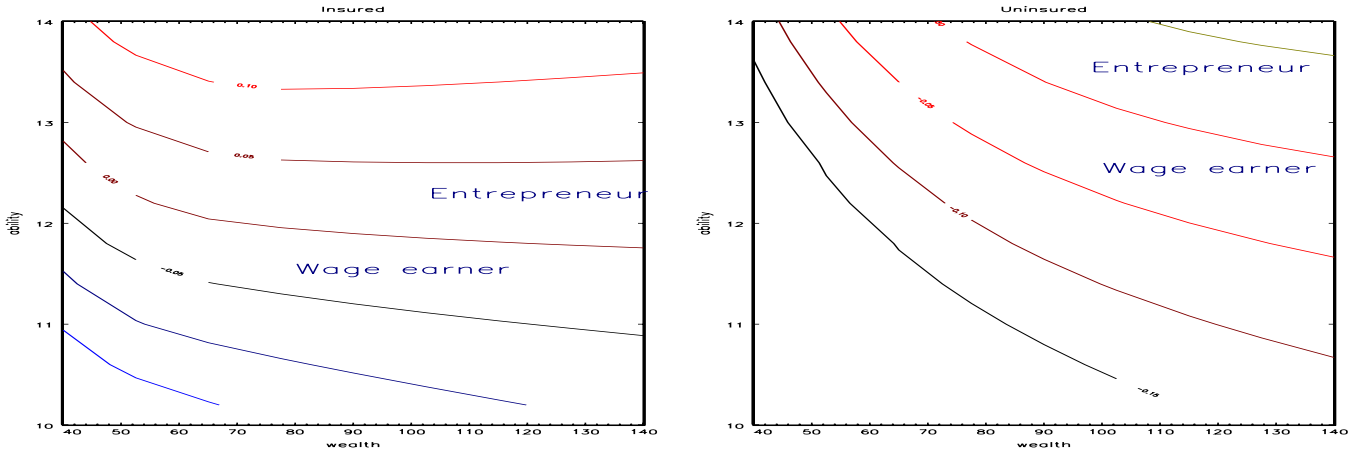
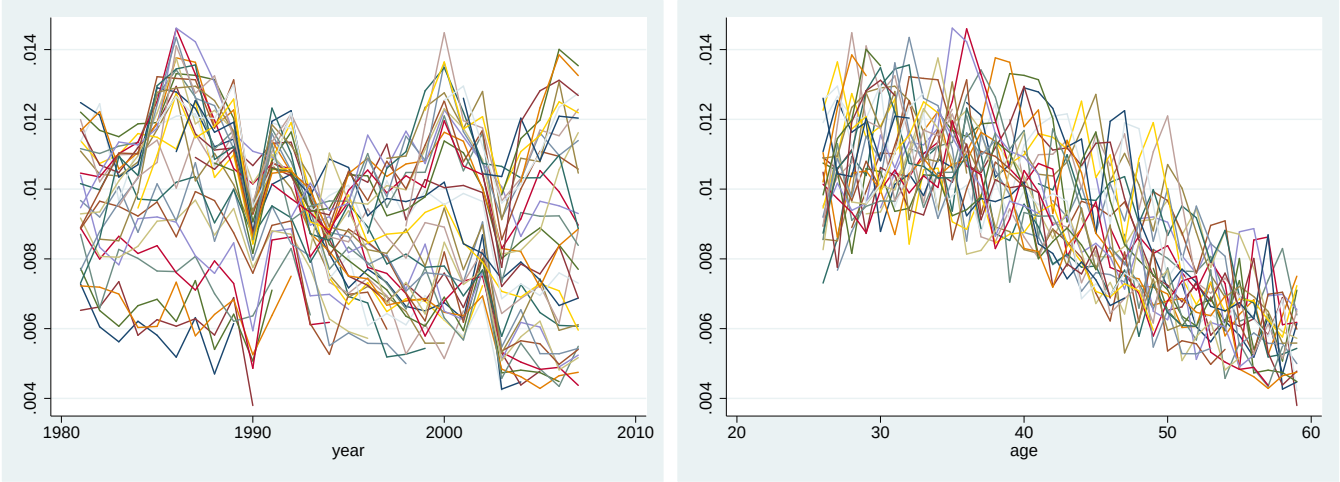


Figure 9: Self-employment Entry from Wage-employment, by year [l] and age [r]



Appendix A.2 Tables

Table 1: Labor Market Status (Per Cent)

year	SE	WE	UE	Totals
1980	10.25	79.97	9.78	934,155
1981	9.81	78.85	11.35	937,829
1982	9.41	79.28	11.31	942,733
1983	9.11	79.54	11.35	946,626
1984	8.94	81.40	9.66	949,408
1985	8.89	83.43	7.68	953,843
1986	9.02	83.73	7.25	958,580
1987	8.98	83.42	7.60	964,029
1988	8.80	81.82	9.38	970,204
1989	8.53	81.76	9.71	977,214
1990	8.12	81.20	10.67	985,972
1991	8.30	80.22	11.47	998,424
1992	8.13	79.70	12.16	1,008,321
1993	7.92	79.07	13.00	1,014,536
1994	7.77	81.16	11.07	1,014,479
1995	7.81	82.59	9.60	1,009,485
1996	7.78	83.33	8.90	1,012,458
1997	7.52	84.23	8.25	1,018,122
1998	7.50	85.00	7.50	1,021,249
1999	7.42	84.79	7.79	1,026,255
2000	7.35	85.26	7.39	1,028,332
2001	7.26	85.16	7.58	1,031,315
2002	6.89	84.45	8.66	1,024,419
2003	6.62	83.97	9.41	1,016,282
2004	6.54	84.39	9.07	1,006,459
2005	6.46	85.57	7.98	995,255
2006	6.49	87.12	6.39	980,508
2007	6.45	87.48	6.07	971,487
2008	6.97	84.94	8.09	961,557
2009	6.81	81.10	12.09	952,401
Total	7.91	82.83	9.26	29,611,937
per cent insured	61.17	82.18	61.94	78.65

Note: Population of Denmark-born Danish prime aged (25-59) men never in agriculture by labor market status.

Table 2: Transitions Into and out of Self-employment

	entry		exit		stock	GDP
from/to	WE	UE	WE	UE	SE	growth
1980/2009	0.95	3.14	8.47	3.58	7.91	1.8
1980/1981	0.92	2.75	6.80	3.67	10.25	-0.9
1981/1982	0.89	2.53	6.70	3.82	9.81	3.7
1982/1983	0.91	2.53	6.94	3.49	9.41	2.7
1983/1984	0.94	2.34	6.90	2.94	9.11	4.2
1984/1985	1.05	3.07	7.67	2.41	8.94	4.0
1985/1986	1.13	3.46	6.95	2.11	8.89	4.9
1986/1987	1.11	2.91	7.57	2.69	9.02	0.3
1987/1988	1.05	2.91	7.95	3.16	8.98	-0.1
1988/1989	1.07	2.99	7.77	4.90	8.80	0.6
1989/1990	0.86	3.04	8.83	4.32	8.53	1.6
1990/1991	1.05	5.64	8.32	3.97	8.12	1.3
1991/1992	1.05	3.51	9.22	4.66	8.30	2.0
1992/1993	0.91	2.99	8.14	5.12	8.13	-0.1
1993/1994	0.85	3.11	8.63	4.12	7.92	5.5
1994/1995	0.87	3.62	7.86	3.38	7.77	3.1
1995/1996	0.87	3.63	7.52	3.39	7.81	2.8
1996/1997	0.85	3.40	8.96	4.07	7.78	3.2
1997/1998	0.84	3.29	8.27	2.19	7.52	2.2
1998/1999	0.88	3.24	8.56	2.67	7.50	2.6
1999/2000	0.96	3.03	9.07	2.98	7.42	3.5
2000/2001	0.90	3.27	9.59	2.31	7.35	0.7
2001/2002	0.95	2.06	9.69	5.28	7.26	0.5
2002/2003	0.72	2.89	9.86	3.42	6.89	0.4
2003/2004	0.80	3.16	8.83	3.89	6.62	2.3
2004/2005	0.85	2.48	9.33	3.24	6.54	2.4
2005/2006	0.90	3.16	9.84	2.50	6.46	3.4
2006/2007	0.90	3.23	10.20	2.90	6.49	1.6
2007/2008	1.43	4.29	9.83	3.16	6.45	-0.8
2008/2009	0.89	3.07	9.88	4.64	6.97	-5.7
% correl. w. GDP growth	-14.38	-3.86	-33.63	-36.80	15.24	

Note: Real GDP growth per capita from Eurostat, series nama_gdp_k, PCH_PRE.

Table 3: Joining UI Fund by Labor Market Status and Force of ER Incentive, 1992 Reform

UI fund entry between $t-1$ and t	labor market status, year $t-1$ self-employed	wage earner	unemployed
all years before ER eligibility			
no	91.00	90.99	92.54
yes	9.00	9.01	7.46
last year to sign up in order to be ER-eligible			
no	75.58	78.20	93.75
yes	24.42	21.80	6.25
years after eligibility incentive (no ER gain from joining)			
no	92.55	93.42	96.15
yes	7.45	6.58	3.85

Note: column percentages.
source population: see note to Table 1, and not UI-fund member in $t-1$.

Table 4: Self-employment Entry by Insurance Status, Estimation Population of Workers

	UI fund member $(t-1)$		Total
Self-employed (t)	no	yes	
no	3,748,876	15,173,588	18,922,464
	98.46	99.21	99.06
yes	58,649	120,932	179,581
	1.54	0.79	0.94
total	3,807,525	15,294,520	19,102,045

Note: column percentages.

Table 5: Probability to Start Up: Linear Fixed Effects Models

		Uninstrumented		Instrumented			
				First Stage		Second Stage	
		self-employed		insured		self-employed	
	lag	coeff.	p-value	coeff.	p-value	coeff.	p-value
UI insured	$t-1$	-0.0015	0.000			0.0175	0.000
ER regime <1992	$t-1$			0.0527	0.000		
ER regime $92-98$	$t-1$			0.0550	0.000		
ER regime $99-07$	$t-1$			0.0343	0.000		
ER regime >2007	$t-1$			0.0218	0.000		
# contr.years	$t-1$			0.0010	0.000		
sign up late option	$t-1$			0.0190	0.000		
age		0.0348	0.000	0.3484	0.000	0.0273	0.000
age$^2 \times 1e-2$		-0.1229	0.000	-1.3302	0.000	-0.1061	0.000
age$^3 \times 1e-4$		0.1745	0.000	2.1133	0.000	0.1464	0.000
age$^4 \times 1e-6$		-0.0923	0.000	-1.2246	0.000	-0.0753	0.000
experience	$t-1$	0.0029	0.000	0.0075	0.000	0.0028	0.000
experience$^2 \times 1e-2$	$t-1$	0.0052	0.000	-0.0173	0.000	0.0055	0.000
experience$^3 \times 1e-4$	$t-1$	-0.0074	0.000	0.0517	0.000	-0.0083	0.000
wage earnings (10k DKK)	$t-2$	8.5e-6	0.346	0.0003	0.000	1.7e-6	0.845
net worth (10k DKK)	$t-2$	-4.1e-9	0.627	-5.2e-8	0.006	-3.1e-9	0.671
home owner	$t-2$	0.0026	0.000	0.0154	0.000	0.0023	0.000
receipt sickness benefits	$t-1$	0.0023	0.000	0.0126	0.000	0.0020	0.000
# kids 0-6	$t-1$	-0.0002	0.136	-0.0026	0.000	-0.0002	0.217
# kids 7-17	$t-1$	0.0001	0.356	-0.0039	0.000	0.0002	0.087
have partner	$t-1$	0.0005	0.045	0.0053	0.000	0.0004	0.101
partner characteristics							
age		9.2e-6	0.188	0.0001	0.000	8.1e-6	0.226
UI insured	$t-1$	0.0001	0.728	0.0839	0.000	-0.0015	0.000
partic. in labor mkt.	$t-1$	0.0011	0.000	-0.0044	0.000	0.0012	0.000
unused earnings capacity	$t-1$	0.0022	0.000	-0.0246	0.000	0.0027	0.000
earnings frontier	$t-1$	-0.0001	0.000	-0.0007	0.000	-0.0001	0.000
region dummies		yes		yes		yes	
industry dummies		yes		yes		yes	
year dummies		yes		yes		yes	
F-test instruments (6 df)				1979.95	0.000		
J-test OI restrictions (5 df)				6.46	0.264		

Note: Based on a 25% sample, size: 3,899,162 observations from 331,227 individuals. Money amounts deflated to 2005. Statistics and p-values based on heteroskedasticity-corrected robust variance-covariance matrix.

Table 6: Sensitivity Analyses

	Variation	UI fund member, $t-1$ coeff.	p-value	F-Test p-value	J-Test p-value	NT	N	Sample
	Linear Fixed Effects model							
	— baseline (Table 5)	−0.0015	0.000			3,924,344	356,409	25%
	Linear Fixed Effects IV model							
	— baseline (Table 5)	0.0175	0.000	0.000	0.264	3,899,162	331,227	25%
1	— net worth dummies replace net worth level	0.0184	0.000	0.000	0.230	3,899,162	331,227	25%
2	— exclude net worth	0.0175	0.000	0.000	0.264	3,899,162	331,227	25%
3	— partner income instead of frontier	0.0178	0.000	0.000	0.256	3,899,163	331,227	25%
4	— partner income variables in logs	0.0176	0.000	0.000	0.252	3,899,162	331,227	25%
5	— 3rd order age polynomial	0.0154	0.000	0.000	0.010	3,899,162	331,227	25%
6	— age dummies replace age polynomial	0.0168	0.000	0.000	0.290	3,899,162	331,227	25%
7	— only age and year dummies and instruments, no other regressors	0.0173	0.000	0.000	0.000	4,742,084	366,927	25%
8	— only 4 ‘ER regime’ instruments	0.0176	0.000	0.000	0.789	3,899,162	331,227	25%
	Random Effects Probit model							
9	— univariate (uninstrumented)	−0.2349	0.000			223,716	16,699	1%
10	— bivariate (instrumented)	0.3425	0.000			223,716	16,699	1%

Notes: This Table reports the estimated coefficient of interest (on the insurance dummy) in the equation of self-employment start-up, when the specification of model assumptions are being changed compared to the main results in Table 5. Full results are available on request.

Table 7: Firm Performance Measures for Firms Starting Up in Year t, by Insurance Status in $t-1$

	Insured	Uninsured	Difference	N
Survival until $t+3$ (%)	44.82	37.54	7.28***	179,581
Conditional on survival until $t+3$:				
(all measurements at $t+3$)				
Mean profit (in k DKK)	408	454	-46***	67,742
Median profit (in k DKK)	307	282	25***	67,742
Fraction with profit ≤ 0 (%)	9.22	14.12	-4.9***	67,742
Sales Revenues (in k DKK)	3349	5652	-2303***	42,447
Value added (in k DKK)	1520	3033	-1513***	42,447
Fraction with employees (%)	46.33	40.20	6.13***	39,543

Survival until $t+3$ means: being self-employed in $t+s, s=1,2,3$

Profit measured at $t+3 \in [1987-2009]$

Value added is sales minus expenses (not wages) measured at $t+3 \in [1990-2007]$

Having employees is measured at $t+3 \in [1995-2008]$

Asterisks indicate significance levels: *** = 1% or lower

Table 8: Firm Performance Measures: IV Regression Analysis

		Survival until $t+3$		Profit $t+3$		Employer $t+3$	
	lag	coeff.	p-value	coeff.	p-value	coeff.	p-value
UI insured	$t-1$	0.2627	0.198	42.18	0.860	0.2568	0.363
age		1.8319	0.000	-174.18	0.445	0.2506	0.400
age$^2 \times 1e-2$		-6.5086	0.000	522.74	0.538	-0.9476	0.340
age$^3 \times 1e-4$		11.0637	0.000	-800.17	0.566	1.6646	0.305
age$^4 \times 1e-6$		-6.9306	0.000	438.04	0.604	-1.0593	0.279
experience	$t-1$	0.0051	0.321				
experience$^2 \times 1e-2$	$t-1$	-0.0049	0.856				
experience$^3 \times 1e-4$	$t-1$	-0.0044	0.926				
wage earnings (10k DKK)	$t-2$	-0.0002	0.600	5.1616	0.001	0.0024	0.000
net worth (10k DKK)	$t-2$	-3.8e-7	0.003	-7.3e-4	0.005	-2.0e-7	0.782
home owner	$t-2$	0.0456	0.005	44.28	0.012	0.0443	0.013
receipt sickness benefits	$t-1$	-0.0489	0.008	-66.70	0.000	-0.0659	0.000
# kids 0-6	$t-1$	0.0105	0.083				
# kids 7-17	$t-1$	-0.0039	0.418				
have partner	$t-1$	-0.0151	0.074	23.60	0.005	0.0131	0.107
partner characteristics							
age		0.0010	0.001	1.2441	0.000	0.0002	0.422
UI insured	$t-1$	-0.0379	0.461	-16.816	0.773	-0.0310	0.635
partic. in labor mkt.	$t-1$	0.0252	0.024	-1.5798	0.901	0.0310	0.010
unused earnings capacity	$t-1$	0.0054	0.808	7.9245	0.823	0.0296	0.399
earnings frontier	$t-1$	2.7e-5	0.963	0.3469	0.501	-0.0007	0.120
education dummies		yes		yes		yes	
region dummies		yes		yes		yes	
industry dummies		yes		yes		yes	
year dummies		yes		yes		yes	
year of birth dummies		yes		yes		yes	
Sample		25%		100%		100%	
NT		30,794		59,151		37,853	
N		26,690		57,430		37,259	
F test (statistic, p-value)		8.10	0.000	15.07	0.000	6.40	0.000
J test (statistic, p-value)		13.128	0.004	0.251	0.969	0.451	0.798

Note: This model shows IV (2SLS) estimates where insurance is allowed to be endogenous, and instrumented with the ER policy reforms. First stage results are available on request. Money amounts deflated to 2005. The estimates for survival are conditional on entering self-employment from wage employment between periods $t-1$ and t. The estimates for profits and being an employer are conditional on entering self-employment from wage employment between periods $t-1$ and t and on surviving in self-employment every year until year $t+3$. Standard errors underlying the p-values have been clustered at the individual level.

Table 9: Sensitivity Analyses on Firm Performance (Survival and Employees)

	Variation	IV?	UI fund member, $t-1$ coeff.	UI fund member, $t-1$ p-value	F test p-value	J test p-value	NT	N	Sample
	Survival								
	— survival until $t+3$ (Table 8)	yes	0.2627	0.198	0.000	0.004	26,690	30,794	25%
1	— survival until $t+3$, full-time	yes	0.3003	0.134	0.000	0.002	26,690	30,794	25%
2	— survival until $t+5$	yes	0.2219	0.237	0.000	0.241	26,690	30,794	25%
3	— joint probability of entry and survival until $t+3$	yes	0.0103	0.000	0.000	0.000	3,899,162	331,227	25%
4	— joint probability of entry and survival until $t+5$	yes	0.0085	0.000	0.000	0.000	3,899,162	331,227	25%
5	— survival until $t+3$	no	0.0930	0.000	—	—	26,690	30,794	25%
6	— survival until $t+5$	no	0.0766	0.000	—	—	26,690	30,794	25%
	Employees								
	— have employees $t+3$ (Table 8)	yes	0.2568	0.363	0.000	0.798	37,853	37,259	100%
7	— number of employees $t+3$	yes	5.9699	0.422	0.000	0.096	37,853	37,259	100%
8	— have employees $t+3$	no	0.0211	0.001	—	—	37,853	37,259	100%

Notes: This Table reports the estimated coefficient of interest (on the insurance dummy) in various equations of firm performance measures, when the specification of model assumptions are being changed compared to the main results in Table 8. Full results are available on request.

Table 10: Sensitivity Analyses on Firm Performance (Profits, Income, and Wealth)

Variation		IV?	UI fund member, $t-1$ coeff.	p-value	F test p-value	J test p-value	NT	N	Sample
	profits $t+3$ Table (8)	yes	42.18	0.860	0.000	0.969	59,151	57,430	100%
11	value added $t+3$	yes	13206.4	0.167	0.000	0.785	40,782	39,890	100%
12	sales $t+3$	yes	11763.2	0.347	0.000	0.982	40,782	39,890	100%
13	business income $t+3$	yes	25.90	0.864	0.000	0.884	59,151	57,430	100%
14	average profits $t+3$ through $t+5$	yes	−312.16	0.127	0.000	0.887	39,547	39,103	100%
15	total income $t+3$	yes	−18.79	0.889	0.000	0.465	113,522	99,061	100%
16	net worth $t+3$	yes	2550.1	0.635	0.000	0.783	103,418	90,676	100%
17	change in net worth $t-1 \to t+3$	yes	1332.6	0.845	0.000	0.548	103,418	90,676	100%
20	profits $t+3$	no	−18.02	0.014	—	—	59,151	57,430	100%
21	value added $t+3$	no	−954.50	0.001	—	—	40,782	39,890	100%
22	sales $t+3$	no	−1560.96	0.000	—	—	40,782	39,890	100%
23	business income $t+3$	no	−9.394	0.058	—	—	59,151	57,430	100%
24	average profits $t+3$ through $t+5$	no	−45.30	0.000	—	—	39,547	39,103	100%
25	total income $t+3$	no	−38.20	0.000	—	—	113,522	99,061	100%
26	net worth $t+3$	no	−614.86	0.013	—	—	103,418	90,676	100%
27	change in net worth $t-1 \to t+3$	no	−390.25	0.187	—	—	103,418	90,676	100%

Notes: This Table reports the estimated coefficient of interest (on the insurance dummy) in various equations of firm performance measures, when the specification of model assumptions are being changed compared to the main results in Table 8. Profits, value added and sales are in 1000 DKK. Wealth and total income measures in 10k DKK. Full results are available on request.

Appendix B Proofs

Appendix B.1 Investment function

To find the optimal investment we solve the first order condition:

$$(1-\pi)\cdot u'(Y^E - sP)\cdot(\gamma\alpha k^{\alpha-1}-1) - \pi\cdot u'(Y^U) = 0$$

which implies

$$(\gamma\alpha k^{\alpha-1}-1) = \frac{\pi}{1-\pi}\times\frac{u'(sB+W-k)}{u'(\gamma k^\alpha + W - k - sP)} \equiv g(k,s). \tag{B.1}$$

We can immediately see that if $\pi = 0$ then $k^* = (\gamma\alpha)^{1/(1-\alpha)}$. We can show that the left hand side of the equation is a decreasing function of k which is positive for $k < (\gamma\alpha)^{1/(1-\alpha)}$ and negative for $k > (\gamma\alpha)^{1/(1-\alpha)}$. For k tending to zero the left hand side tends to infinity. To simplify the notation we define the function $g()$ to be the right hand side of equation (B.1). We can see that (B.1) is always non-negative and only zero if $\pi = 0$. In the following we assume that $\pi \neq 0$. Furthermore we can show that for $k = 0$, $g()$ is given by

$$\frac{\pi}{1-\pi}\times\frac{u'(sB+W)}{u'(W-sP)} > 0$$

and is finite. We can also show that $g()$ is an increasing function for $k < (\gamma\alpha)^{1/(1-\alpha)}$:

$$\frac{\partial g(k)}{\partial k} = \frac{\pi}{1-\pi}\cdot \frac{-u''(sB+W-k)u'(\gamma k^\alpha + W - k - sP) - u'(sB+W-k)u''(\gamma k^\alpha + W - k - sP)(\gamma\alpha k^{\alpha-1}-1)}{[u'(\gamma k^\alpha + W - k - sP)]^2}$$

From the expression above it is clear that $\partial g(k)/\partial k > 0$ if $k < (\gamma\alpha)^{1/(1-\alpha)}$. The optimal investment is therefore in the interval $[0;\ (\gamma\alpha)^{1/(1-\alpha)}]$ (see Figure B.1).

To derive the effect of π, s, B, P, W and γ we use the implication of these variables on $g()$. For all variables except γ the left hand side of equation (B.1) is unaffected.

The probability of unemployment First we can easily show that g is increasing in π. This implies that π has a negative impact on the optimal investment.

The insurance status Here we can show that $g(k,s=1) < g(k,s=0)$ for all k. Since we have assumed that $u'' < 0$ we know that $u'(B+W-k) < u'(W-k)$ and $u'(\gamma k^{\alpha}+W-k-P) > u'(\gamma k^{\alpha}+W-k)$. Then it follows that

$$\underbrace{\frac{\pi}{1-\pi} \times \frac{u'(B+W-k)}{u'(\gamma k^{\alpha}+W-k-P)}}_{g(k,s=1)} \quad < \quad \underbrace{\frac{\pi}{1-\pi} \times \frac{u'(W-k)}{u'(\gamma k^{\alpha}+W-k)}}_{g(k,s=0)}$$

and $k^{*1} \geq k^{*0}$. We can in a similar way show that g decreases with UI benefit B and increases with UI premium P. Then it follows that the optimal investment increases with B and decreases with P.

Wealth Without further assumptions, we cannot determine how wealth W will affect the g function. In general, the effect will depend on u''' and the relative size of $sB+W-k$ and $\gamma k^{\alpha}+W-k-sP$.

Abilities as entrepreneur To assess the impact of the ability as entrepreneur γ, we can show that the left hand side function will increase as γ increases. The right hand side will also increase when γ increases. Therefore we are not able to sign the impact of ability on the optimal investment without making additional assumptions.

Appendix B.2 Proofs for the occupational choice

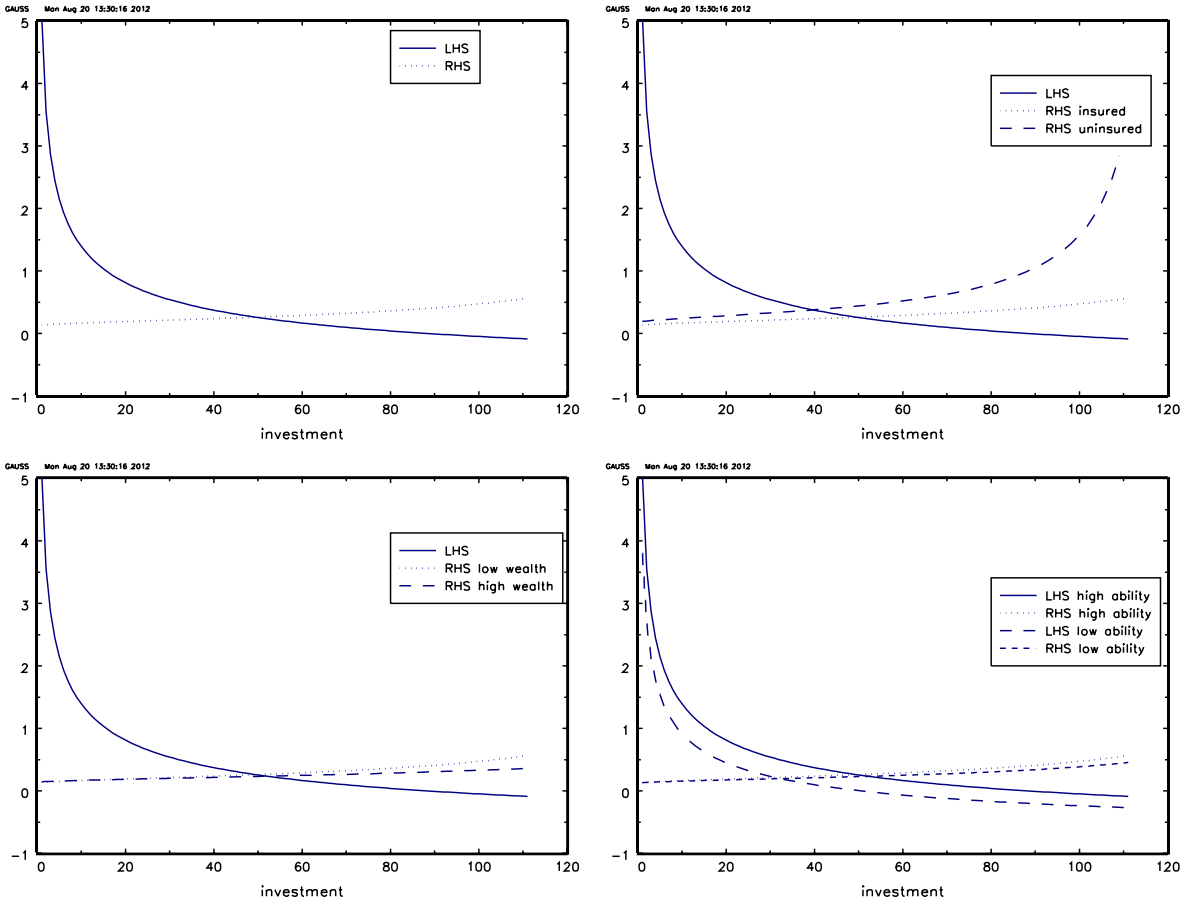
We show how the occupational choice depends on wealth. For an uninsured agent we can define the expected utility as entrepreneur as:

$$U^{E0} = (1-\pi^{E}) \cdot u(\gamma(k^{*0})^{\alpha} + (W-k^{*0})) + \pi^{E} \cdot u(W-k^{*0}).$$

We find the derivative of the expected utility with respect to wealth W

$$\begin{aligned}
\frac{\partial U^{E0}}{\partial W} &= (1-\pi^{E}) \cdot u'(\gamma(k^{*0})^{\alpha} + (W-k^{*0})) \left[\left((\alpha\gamma)(k^{*0})^{\alpha-1} - 1 \right) \frac{\partial k^{*0}}{\partial W} + 1 \right] \\
&\quad + \pi^{E} \cdot u'(W-k^{*0}) \left[1 - \frac{\partial k^{*0}}{\partial W} \right] \\
&= (1-\pi^{E}) \cdot u'(\gamma(k^{*0})^{\alpha} + (W-k^{*0})) + \pi^{E} \cdot u'(W-k^{*0}) > 0
\end{aligned}$$

Figure B.1: Optimal Investment



where the last equality follows from the fact that k^{*0} is the solution to the first order condition (1). The derivative for the expected utility as wage earner is given by

$$\frac{\partial U^{W0}}{\partial W} = (1-\pi^W)\cdot u'(Y^W+W))+\pi^W\cdot u'(W) > 0.$$

To sign the effect on the occupational choice we need to assume that $\pi^E \geq \pi^W$ and $\gamma(k^{*0})^\alpha - k^{*0} \leq Y^W$. In this case wealth will increase the expected utility more for the entrepreneur than the wage earner and thus lead to a positive wealth gradient in the choice of entrepreneurship.